Report No. FAA-RD-79-9

COMPARISON OF MEASURED DATA WITH IF-77 PROPAGATION MODEL PREDICTIONS

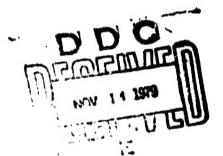
M.E. Johnson and G.D. Gierhaid

U.S. DEPARTMENT OF COMMERCE

NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION

BOULDER, COLORADO 80303





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FEDERAL AVIATION ADMINISTRATION SYSTEMS RESEARCH AND DEVELOPMENT SERVICE SPECTRUM MANAGEMENT STAFF

STATEMENT OF MISSION

The mission of the Spectrum Management Staff is to assist the Department of State, National Telecommunications and Information Administration, and the Federal Communications Commission in assuring the FAA's and the nation's aviation interests with sufficient protected electromagnetic telecommunications resources throughout the world and to provide for the safe conduct of aeronautical flight by fostering effective and efficient use of a natural resource - the electromagnetic radio frequency spectrum.

This objective is achieved through the following services:

- Planning and defending the acquisition and retention of sufficient radio frequency spectrum to support the aeronautical interests of the nation, at home and abroad, and spectrum standardization for the world's aviation community.
- Providing research, analysis, engineering, and evaluation in the development of spectrum related policy, planning, standards, criteria, measurement equipment, and measurement techniques.
- Conducting electromagnetic compatibility analyses to determine intra/intersystem viability and design parameters, to assure certification of adequate spectrum to support system operational use and projected growth patterns, to defend aeronautical services spectrum from encroachment by others, and to provide for the efficient use of the aeronautical spectrum.
 - Developing automated frequency selection computer programs/routines to provide frequency planning, frequency assignment, and spectrum analysis capabilities in the spectrum supporting the National Airspace System.
- Providing spectrum management consultation, assistance and guidance to all aviation interests, users, and providers of equipment and services, both national and international.

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COMPARISON OF MEASURED DATA WITH IF-77 PROPAGATION MODEL PREDICTIONS

M. E. Johnson and G. D. Gierhart1

1. INTRODUCTION

Assignments for aeronautical radio in the radio frequency spectrum must provide reliable services for an increasing air traffic density [18]. Potential interference between facilities operating on the same or on adjacent channels must be considered in expanding present services to meet future demands. Service quality depends on many factors including the desired-to-undesired signal ratio at the receiver. This ratio varies with receiver location and time even when other parameters, such as antenna gain and radiated powers, are fixed.

The IF-77 (ITS-FAA-1977) propagation model described in Section 3 was developed by the Institute for Telecommunication Sciences (ITS) under sponsorship of the Federal Aviation Administration (FAA). It has been incorporated into ten computer programs that are useful in estimating the service coverage of radio systems operating in the frequency band from 0.1 to 20 GHz. They may be used to obtain a wide variety of computer-generated microfilm plots [20]. The capabilities and input requirements of these programs are discussed in an Applications Guide [21].

Extensive comparisons of measured data with predictions made by IF-77 and other models are provided in Section 4. They supplement similar comparisons previously provided by Smith [36]. Because they are so voluminous, the Summary and Conclusions

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References are listed alphabetically by author at the end of the report so that reference numbers do not appear sequentially in the text.

have been placed as Section 2. The aeronautical data pool from which these data were selected is discussed in Appendix A. A guide to the abbreviations, acronyms, and symbols used in this report is provided in Appendix B.

2. SUMMARY AND CONCLUSIONS

Extensive comparisons of measured radio propagation data with predictions made by IF-77 and other models are provided. Data from four sources were used. This includes data provided in two reports (FAA-RD-75-165,I [12] and OT/TRER 16 [20]), data collected utilizing the Midwest Program on Airborne Television Instruction (MPATI) aircraft [13], and unpublished data obtained with the ITS Radio Spectrum Measurement System (RSMS). A summary of the data used is provided in Table 1. Only those paths for which the IF-77 model is applicable were selected for comparison. For example, only about 25 percent of the paths in OT/TRER 16 were suitable since the IF-77 model is not applicable to paths with two horizons formed by irregular terrain (Sec. 3). To facilitate additional work with these data such as comparison

Table 1. Summary of Data Used*

Source	Data Type	Paths	Data Hours	
FAA-RD-75-165,I (Sec. 4.1)	Ground-to-air (instantaneous levels)	28	20	
MPATI (Sec. 4.2)	Air-to-ground (hourly medians)	6	4,130	
OT/TRER 16 (Sec. 4.3)	Ground-to-ground (hourly medians)	202	866,000	
RSMS (Sec. 4.4)	Ground-to-ground (hourly medians)	6	167	
	TOTALS	242	870,317	

Limited to the paths and hours used for comparison with predictions in this report.

with predictions made by other models, we have included the actual data and terrain profiles from the source documents as well as path prediction parameters.

Except for the Section 4.1 data, the data sources contained comparisons with predictions made using models other than IF-77. These have been retained so that IF-77 predictions can be compared with both data and predictions using other models. However, the only predictions that are compared with all data are those made with the IF-77 and Free Space models. A summary of the prediction models is provided in Table 2.

Statistics for the difference, ΔL , between prediction and observation are provided for the data of Sections 4.2 through 4.4. Such statistics were not developed for the Section 4.1 data because (1) sufficient data to estimate median values were not available, and (2) the aircraft antenna pattern is unknown so that an isotropic aircraft antenna was assumed in the predictions. Composite statistics for ΔL are provided in Table 3.

Conclusions may be summarized as follows:

- (1) Although, as previously mentioned, AL statistics were not developed for the FAA-RD-75-165, I data, the comparisons provided in Section 4.1 indicate that the IF-77 model provides better predictions than the free space model even when line-of-sight conditions prevail. The differences between measured and predicted curves would be expected to be less if the aircraft antenna pattern could have been included in the predictions in place of the isotropic pattern that was assumed. Furthermore, the data consisted of a single run for each altitude. It would have been desirable if there had been more runs to show the variability of data.
- (2) Statistics for variability of the data were not developed. However, a visual inspection

Table 2. Summary of Prediction Models

Model	Comments	
Eg1i [11]	Used in Section 4.4 only. The Egli model was developed to predict land-mobile radio (LMR) base-to-mobile coverage areas. Terrain profiles are not used so that more complex models that require such information would be expected to yield better results.	
ESSA 1970 [25, Sec. 3.5]	Used in Sections 4.3 and 4.4. The ESSA 1970 model is an improved version of the Longley-Rice model for the point-to-point mode where terrain profile information is used to determine horizon parameters. Predictions made with it in Section 4.3 used the same formulation for variability as the TN 101 model.	
FCC [8]	Used in Section 4.4 only. The FCC model was developed to predict LMR base-to-mobile coverage areas. If terrain profile information is available, more complex models that utilize it would be expected to yield better results.	
Free Space [33, p. 2-7]	Used in Sections 4.1, 4.2, 4.3, and 4.4. Terrain and atmosphere are neglected in the Free Space model so that transmission loss between isotropic antennas depends only on radio frequency, f in MIz, and ray path length, r in km; i.e., basic transmission loss, Lbf, is given by	
IF-77	$L_{\rm bf}$ = 32.45 + 20 $\log_{10}({\rm fr})$ dB Used in Sections 4.1, 4.2, 4.3, and 4.4 and	
[21]	described in Section 3. The IF-77 model was developed to accommodate very high antennas (aircraft or satellite) where detailed terrain information for the highest antenna can be neglected. It can be used for paths with low antennas that are line-of-sight, smooth earth, or have a common horizon. This model has much in common with the Longley-Rice and TN 101 models.	

Table 2. Summary of Prediction Models (continued)

Mode1	Comments	
Longley-Rice [24]	Used only in Section 4.4. The Longley-Rice model was developed to predict transmission loss in irregular terrain. It has an "area mode" in which the terrain is described only by a terrain irregularity parameter and a "point-to-point mode" which uses path profile information instead of the terrain parameter to determine horizon parameters. Since the ESSA 1970 model is an improved version of the point-to-point mode, only the area mode was used.	
OT/TRER 21 [13, App. A]	Used only in Section 4.2. The OT/TRER 21 is a version of ESSA 1970 that was modified to provide predictions for comparison with the MPATI data. This involved compensation for (1) the high elevation of one terminal (MPATI aircraft at 6 km) and (2) the limited duration (between 9 a.m. and 2 p.m.) of the MPATI transmissions by using a time block formulation for variability [33, Sec. 10].	
Okumura [30]	Used only in Section 4.4. The Okumura model was developed to predict base-to-mobile coverage areas. For such an application, it is more complex than the Egli model and less complex than the Longley-Rice model. Although it does include some factors based on terrain profile information, more complex methods that make greater use of terrain profile information would be expected to yield better results when such information is available.	
TN 101 [33]	Used only in Section 4.3. The TN 101 model involves using the most appropriate of several methods provided in Technical Note 101. This model is expected to provide good results for ground-to-ground paths when terrain profile information is available, but is not expected to do as well on line-of-sight paths as ESSA 1970.	

Table 3. Summary of Results (a)

Mode1	<u>AL</u> (b) [dB]	MAX AL (c) [dB]	Path (d) No.
Best (e)	- 3	- 34	11998
IF-77	~ 5	-32	11978
Free Space	- 34	- 96	10260

⁽a) Compiled using ΔL statistics for different data sources; i.e., MPATI (Table 6), OT/TRER 16 (Table 7), and RSMS (Table 10).

$$\Delta L = L_{bm}(predicted) - L_{bm}(observed) = P_R(observed)$$
- $P_R(predicted) dB$

The mean ΔL for the 193 paths involved is ΔL . Only 193 of the 242 paths used had median values for the data.

⁽b) Determined using median basic transmission loss, L_{bm} in dB, or median received power levels, P_{p} in dBm; i.e.,

⁽c) The ΔL value (sign included) corresponding to the maximum absolute value of ΔL encountered. This statistic picks out the worst ΔL 's encountered. The first two identify data that are difficult to explain with any of the models tested, and the last one is a case where free space is simply a poor model since a transhorizon path is involved.

⁽d) The path number for the path with MAX $|\Delta L|$.

⁽e) The best model of those tested for the different data sources; i.e., MPATI (OT/TRER 21), OT/TRER 16 (ESSA 1970), and RSMS (IF-77).

of the comparisons indicate that the variability formulation of the IF-77 model does a good job in most cases; i.e., the shapes are in good agreement. In a few specific cases the TN 101 variability formulation (also used for ESSA 1970) provides better agreement with the data, and for a few the opposite is true (see Sec. 4.3 discussion).

- (3) The Free Space model was always among the worst predictors. This is as expected since only a few of the paths involved were line-of-sight with good terrain clearance.
- (4) The IF-77 model provided the best predictions for the ground-to-air data of Section 4.1 and the ground-to-ground data of Section 4.4. It was second best for the air-to-ground data of Section 4.2 (OT/TRER 21 was best of three) and ground-to-ground data of Section 4.3 (ESSA 1970 was best of four). Hence, it was always one of the best two models and provided predictions better or nearly as good as the other models tested.
- (5) The IF-77 model has a wide range of application and provided predictions compatible with the more specialized models tested for the data provided here. However, these comparisons did not include applications such as air-to-air or ground-to-satellite paths, and these additional comparisons would be desirable.

3. THE IF-77 PROPAGATION MODEL

During 1960-1973, an air/ground propagation model applicable to irregular terrain was developed by ITS for the FAA and was documented in detail [15]. This IF-73 (ITS-FAA-1973) propagation model has evolved into the IF-77 model which is applicable to air/ground, air/air, ground/satellite, and air/satellite paths. It can also be used for ground/ground paths that are

line-of-sight, smooth earth, or have a common horizon. Model applications are restricted to telecommunication links operating at radio frequencies from about 0.1 to 20 GHz with antenna heights greater than 1.5 ft (0.5 m). In addition, the elevation of the radio horizon must be less than the elevation of the higher antenna. The radio horizon for the higher antenna is taken either as a common horizon with the lower antenna or as a smooth earth horizon with the same elevation as the lower antenna effective reflecting plane [15, Sec. A.4.1.]. Input parameters for IF-77 are summarized in Table 4 and discussed in the Applications Guide [21, Sec. 4].

At 0.1 to 20 GHz, propagation [2, 4, 9, 10, 32] of radio energy is affected by the lower, nonionized atmosphere (troposphere), specifically by variations in the refractive index of the atmosphere. Atmospheric absorption and attenuation or scattering due to rain become important at SHF [15, Sec. A.4.5; 22, Ch. 7; 33, Ch. 3; 35]. The terrain, along and in the vicinity of the great circle path between transmitter and receiver, also plays an important part. In this frequency range, time and space variations of received signal and interference ratios are best described statistically [29; 33, Sec. 10].

Conceptually, the model is very similar to the Longley-Rice [24] propagation model for propagation over irregular terrain, particularly in that attenuation versus distance curves calculated for the (a) line-of-sight [15, Sec. A.4.2], (b) diffraction [15, Sec. A.4.3], and (c) scatter [16, Sec. 5] regions are blended together to obtain values in transition regions. In addition, the Longley-Rice relationships involving the terrain parameter, Δh , are used to estimate radio horizon parameters when such information is not available from facility siting data [15, Sec. A.4.1]. The model includes allowance for

- (a) average ray bending [4, Eqs. 3.44, 3.43, 4.30; 5; 15, p. 44; 33, Sec. 4],
- (b) horizon effects [15, Sec. A.4.1],
- (c) long-term fading [15, Sec. A.4; 16, Sec. 5; 33, Sec. 10],

Table 4. Input Parameters for IF-77

Parameter	Ainge
Aircraft (or higher) antenna height above	≥ facility horizon height.
ean sea level (wal). acility (or lower) antenna haight above acility site surface (fss).	> 1.5 ft (0.5 m) above fas.
requency	0.1 to 20 GHz.
Specification of the follo	wing parameters is optional
Aircraft antenna type options. Polarization options. Tracking options.	Tsotropic* or as specified. None, identical with facility. Directional* or tracking.
tige and of the state of the st	As fust or a specified value.

Effective reflection surface elevation above mal. Equivalent isotropically radiated power. Facility antenna type options.

Counterpoise diameter. Height above fis. Polarization options. Tracking.

Gain, receiving antenna (main beam). Transmitting antenna (main beam). Transmitting antonna location.

Horizon obstacle distance from facility.

Elevation angle above horizontal at facility Height above msl.

lesospheric scintillation options. Rain attenuation options.

Refractivity options. Effective earth's radius. Or minimum menthly mean, No. Surface reflection lebing options.

Surface type options.

£

Sea state. Or rms wave height, oh. Temperature Terrain elevation above mal at facility. Parameter, &h. Time availability eptions.

> Climates. Or time blocks.

0.0 dBW" or specified. Isotropic* or as specified. 00 to 500 ft (152 m). 00 to 500 ft (152 m). Morisontal,* vertical, or circular. Directional* or tracking. 0* to 60 dB1. 00 to 60 481. Aircraft or facility*.

From 0.1 to 3 times smooth earth horizon distance (calculated*). « 12 deg (calculated*).

0* to 15,000 ft-mal (4572 m-mai) and < mir-No scintillations or specified by index group. None* or computed using attenuation rate or rain tone.

4010 to 4070 m mi (7427 to 11,242 km). 208 to 400 N-units (301 N-units*). Contributes to variability or determines mediam level.

Poor, average* or good ground, fresh or sea water, concrete, metal.

0 to .

0 to 164 m (50 ft).

0, 10,° or 20°C.

0° to 15,000 ft-ms1 (4372 m-ms1).

For instantaneous levels exceeded or for hourly median levels exceeded.

Continental all years or seven others.

1 through 8, summer, winter.

Values or options that will be assumed when specific designations are not made are flagged by asterisks.

- (d) antenna patterns [16, Sec. 3.4; 21, Sec. 4],
- (e) surface reflection multipath [6; 7; 14, p. 17; 15, Sec. A.6; 16, Sec. 3; 17, Sec. CI-D.7],
- (f) tropospheric multipath [3; 14, Sec. 3.1; 15, Sec. A.7; 19; 23, pp. 60, 119, B-2],
- (g) atmospheric absorption [15, Sec. A.4.5; 33, Fig. 3.1],
- (h) ionospheric scintillations [1; 14, Sec. 2.5; 16, Sec. 4.5; 17, Sec. CVII; 31; 37], and
- (i) rain attenuation [9, 27, 35].

The model is an extended version of the model previously described in detail by Gierhart and Johnson [15, Sec. A]. These extensions include provisions for

- (a) sea state [16, Sec. 3.1],
- (b) a divergence factor [16, Sec. 3.2; 34].
- (c) a ray length factor for situations where the free-space loss associated with a surface reflected ray may be significantly greater than that associated with the direct ray [16, Sec. 3.3],
- (d) an antenna pattern at each terminal [16, Sec. 3.4].
- (e) circular polarization [16, Sec. 3.5],
- (f) frequency and temperature variations or the complex dielectric constant of water [16, Sec. 3.5],
- (g) long-term power fading as a function of radio climatic region [16, Sec. 4.3; 28, Sec. 4.4.25] or time block [16, Sec. 4.2],
- (h) rain attenuation [16, Sec. 4.4],
- (i) ionospheric scintillation [16, Sec. 4.5],
- (j) an improved method for calculating the transmission loss associated with tropospheric scatter [16, Sec. 5],
- (k) an aircraft antenna pattern [16, Sec. 10.1],

- (1) ray elevation angle adjustment factors to allow for ray tracing [16, Sec. 10.2],
- (m) antenna tracking options [16, Sec. 10.3],
- (n) an improved estimate of the distance, (d_o), where horizon effects can be neglected [16, Sec. 7],
- (o) a free-space loss formulation that is applicable to very high antennas [16, Sec. 8], and
- (p) a formulation for facility horizon determinations that includes ray tracing [16, Sec. 9.2].

4. COMPARISON OF DATA WITH PREDICTIONS

Many comparisons of data with predictions made by the IF-77 and other models are provided in this section. These are blocked by data sources: i.e., DOT Report FAA-RD-75-165, I data, the Midwest Program on Airborne Television Instruction (MPATI) data, DOC Report OT/TRER 16 data, and Radio Spectrum Measurement System (RSMS) data. Information on extent of data used from the various sources was provided in Table 1 (Sec. 2); i.e., number of paths and hours. Figures are grouped at the end of each section by increasing path number. These figures provide path parameter information and the comparison of data with predictions.

The parameter sheets are those used with the aeronautical data pool described in Appendix A, where a detailed discussion of the parameter sheet is included (Sec. A.1). Metric units are used exclusively on the parameter sheets, but English equivalents can easily be obtained by using values from the conversion factor chart provided in the front of this report. Parameter values are those given in the data source or are estimates (thought to be reasonable) made as part of the prediction process. Parameter values are flagged when they are not taken directly from the data source with, perhaps, a simple unit conversion.

Other information such as path profiles is included when it is available in the data source. Profiles are presented as they were provided in the data source. Units or scales were not modified.

Comparisons with data follow the path descriptive information and are shown, in most cases, as curves added to figures taken directly from the data source. Units and scales associated with the data source figures were not modified so that English units are sometimes used. Metric equivalent values or scales are not shown on these figures but are given on the parameter sheets. Other metric values can easily be obtained by using conversion factors from the chart provided in the front of this report.

4.1 FAA-RD-75-165,I DATA

Predictions made with the IF-77 and Free Space models (Table 2) are compared with data from the Department of Transportation (DOT) report FAA-RD-75-165,I [12] in this section. These data were collected with a receiver on board FAA Flight Inspection Aircraft N-67 in the vicinity of Chickasha, Oklahoma. The data used for comparison with predictions were recorded for approximately 20 hours on 28 paths.

Parameters for the Very High Frequency Omni Range (VOR) and Instrument Landing System (ILS) localizer (LOC) transmitters involved are summarized in Figures 1 and 2, respectively. These parameters were estimated from information given in the report [12. Fig. 2 and 5]. Parameters for the various paths are similar except for path number, path code, aircraft altitude, and station separation when it is applicable (Figs. 19 through 30). These parameters are summarized in Table 5. All predictions provided in this section were made using the variability option so that ground reflection multipath is included in the predicted variability, and lobing associated with the ground reflection is not allowed to influence the predicted median level inside the horizon lobe (Table 4). Predictions for Figures 3 through 18 were made with program ATOA, while those for Figures 19 through 30 were made with program ADUDD [21, Table 1]. Figures 3 through 10 are for VOR transmissions, and Figures 11 through 18 are for LOC transmissions where the data are receiver input in microvolts

Table 5. Additional Section 4.1 Parameters

												_					Station Separation	Kiloseterstoj	74	76	Z:	-			3	9	9	•	9	•
Alrcraft Altitude(a) Meters above Ground(a)		# 100 m	504.6	9.64	1214	1524	2008	4572	152.4	304.8	9.609	914.4	1219	1524	# TON	7/53			304.6	9.509	914.4	1219	2004	7/57	152.4	304.6	9.609	914.4	6171	1524
Station Type	Signal Strength	Non	300	104	30A	400	407	YOR	307	207	201	501	š	201	201	353		Desired/Undesired	V04/10V	VOR/LOC	NOR/LOC	V0#/LOC	301/BOA	301/804	NOR/10C	NOR/10C	VOR/LOC	201/100	NOW/FOC	X08/10C
Code Number (see Sec. A.1)		0105 7220	6105 7220	0105 7220	6165 7220	0105 7220	#221 #165 7226 2411	0105 7220	0105 7120	6105 7126	6105 7120	0105 7120	8105 7128	0165 7120	1192 0212 5010 1220	0105 7120			4145 7674	0105 7020	0105 7020	9105 7020	1221 0105 7020 2811	0105 7626	9105 7026	0105 7026	0105 7020	8105 7020	8185 7028	0105 7020
Path Mesber		40001	40002	40003	40004	\$000 *	\$000 7	4000	60007	01007	46011	40012	60013	*100*	40015	\$1007				4001	40019	40020	12007	40022	40023	4.0024	40025	40026	46027	40628
Figure		n	•	S	•	_	-		:=	1.2		=	2	*	17	=			•		12	77	23	=	22	52	27	28	53	*

(a) Converted with four significant figures from values given in feet on the figures.
(b) Converted with two significant figures from values given in nautical miles on the figures.

(1 μV across 50 Ω = -137 dBW) versus aircraft-to-station distance in nautical miles (1 Nm = 1.852 km). Desired (VOR) to undesired (LOC) signal ratios (D/U) versus distance from the undesired facility data are given in Figures 19 through 30.

Because of the nominal nature of the parameters used for the predictions, which include an assumed isotropic aircraft antenna, comparisons between measured and predicted values are provided only by the addition of predicted curves to the copies of graphs from FAA-RD-75-165,I [12] that show the measured data; i.e., statistical comparisons were not developed.

A better comparison between predicted and measured data would have been possible if each flight had been repeated several times. Additional data for each flight path would give an indication of the variability.

Some observations concerning these comparisons are as follows:

- (1) The facility antenna patterns used in the predictions have a null (-18 dB) for elevation angles near 90° [21, Fig. 45, cosine pattern]. This null can be seen in the IF-77 and Free Space predictions at zero distance (e.g., Fig. 9). While the actual facility antenna would be expected to have a similar characteristic, it is probably masked by experimental conditions such as time constants associated with the recording instrumentation, aircraft location uncertainty and aircraft antenna gain.
- (2) The variability mode was used in the IF-77 predictions. This causes the variability to increase in the region where terrain reflection lobing would be present and neglects such lobing in the median level. Lobing caused by counterpoise reflection is included in the median only. Figure 9 illustrates these characteristics. Also note that data for the terrain reflection exceeds

the free space level by more than the maximum theoretical amount (6 dB) for a single reflection. Aircraft antenna gain is probably responsible for this since 0 dB gain was assumed in the predictions. A signal level lower by an average of 5.5 dB on from facility flights was observed, and only those data for to facility flights were plotted in FAA-RD-75-165, I [12, p. 4].

- (3) Agreement between data and predictions seems to decrease with increasing altitude (e.g., Figs. 3 through 10). This is because the variability mode does not show terrain reflection lobing in the median level, and the data clearly show such lobing (Fig. 9).
- (4) For a fixed aircraft location relative to an undesired station, an increase in D/U would be expected if the facility separation is reduced because the distance to the desired facility would be less. Both the data and predictions follow this expectation in that D/U's for the 40 Nm facility separation set (Figs. 19 through 24) are less than those for the 25 Nm separation set (Figs. 25 through 30).
- (5) For fixed facility separation, fixed aircraft to undesired facility distance, and the aircraft near the undesired facility, an increase in D/U would be expected as aircraft altitude increases since an improvement in terrain clearance for the desired facility to aircraft path would usually increase the desired signal level. Both the data and predictions usually follow this expectation [Figs. 19 through 30].
- (6) The comparisons provided in this section indicate that the IF-7? model provides better predictions than the Free Space model even when line-of-sight conditions prevail.

	, ,	20 4 0 0 0	
Path Number:		to 4 0 0 2 8	
Code Number: 0 2 2 1 0 1 0 Location: Near Chickasha, Oklahoma about 10 hours of Data type instantaneous measuremen	& Distance varies	. 8 1 1 km,h _{rs} 0*	m-ms1
N 301* N-units, a	km, Surface type_	average ground	
Climate continental temperate	, (6	km
Frequency 110.6 MHz, Transmitt	er output	_dBW, EIRP21.3	dBW
Δh <u>0</u> m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	4.88		
gain [dBi], main beam	2.15	. 0 •	
height [m], above site surface	4.88		
line loss [dB]	3.0	0*	
polarization	Н	Н	
type	Cosine pattern	Isotropic*	
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	35°29'14"N		
longitude	97°59'21"W		
Path bearing			
elevation [m-msl]			
Other information:			

Table 5 and figures cited there.

FAA-RO-75-165, I, p. 1 to 4 and A-1 to A-11.

*A smooth effective earth with a "4/3" radius was assumed along with an isotropic aircraft antenna. Data for elevations "above ground" should be compared with predictions for the same elevation above msl. A portable VOR (on a truck) with a counterpoise was estimated to be 3.66 m in diameter and 3.66 m above ground. The VOR was first placed 40 n mi directly north of Chickasha, Oklahoma, at Okarche, Oklahoma, and later moved to El Reno, Oklahoma, 25 n mi directly north of Chickasha.

Figure 1. Paths 40001 through 40008 and 40017 through 40028, parameters, VOR.

Path Number:		9 to 4 0 0 2 8	
Code Number: 0 2 2 1 0 1 0 Location: Near Chickasha, Oklahoma about 10 hours of Data type instantaneous measurement N. 301* N-units, a	t. Distance <u>v<i>ari</i></u>	es km.h _{rs} 0#	m-ms 1
Climate continental temperate		, d _e	km
Frequency 110.5 MHz, Transmitt	ter output	dBW, EIRP 23.3	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1.68		
gain [dBi], maîn beam	1.0	0*	
height [m], above site surface	1.68		
line loss [dB]	0.0	0*	
polarization	Н	Н	
type	Cosine pattern	1sotropic*	
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude	35°09'19"N		
long i tude	97°58' 09"W		
Path bearing			
elevation [m-msl]			
Other information:			

Table 5 and figures cited there.

FAA-RD-75-165, I, p. 1 to 4 and A-1 to A-11.

*A smooth effective earth with a "4/3" radius was assumed along with an isotropic aircraft antenna. Data for elevations "above ground" should be compared with predictions for the same elevation above msl.

Figure 2. Paths 40009 through 40028, parameters, LOC.

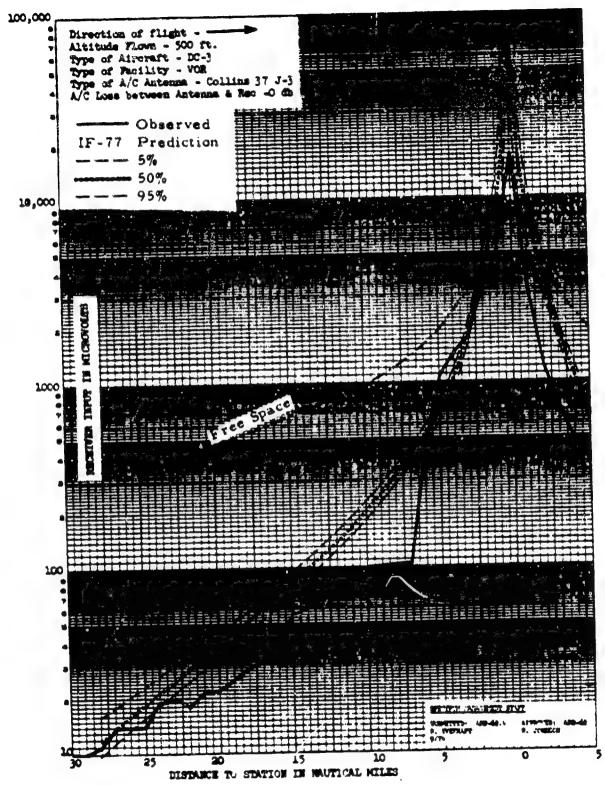


Figure 3. Path 40001, data [10, p. B-1].

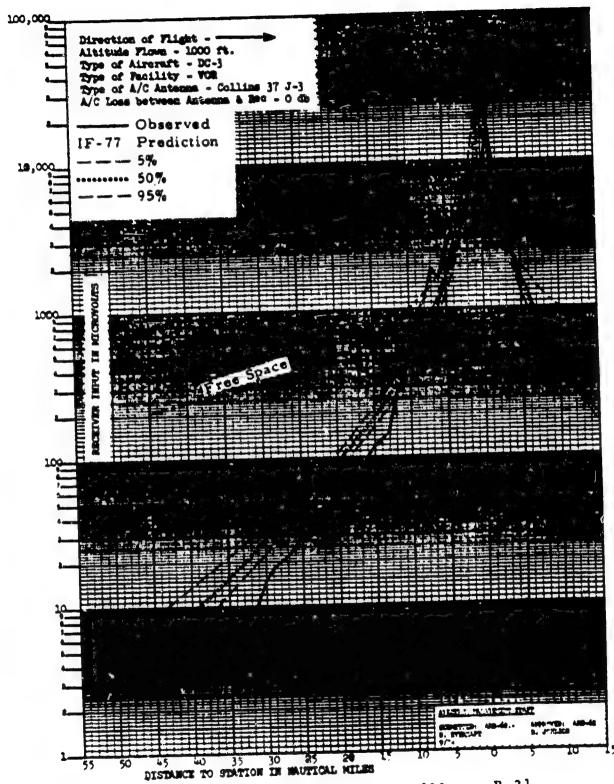


Figure 4. Path 40002, data [10, p. B-2].

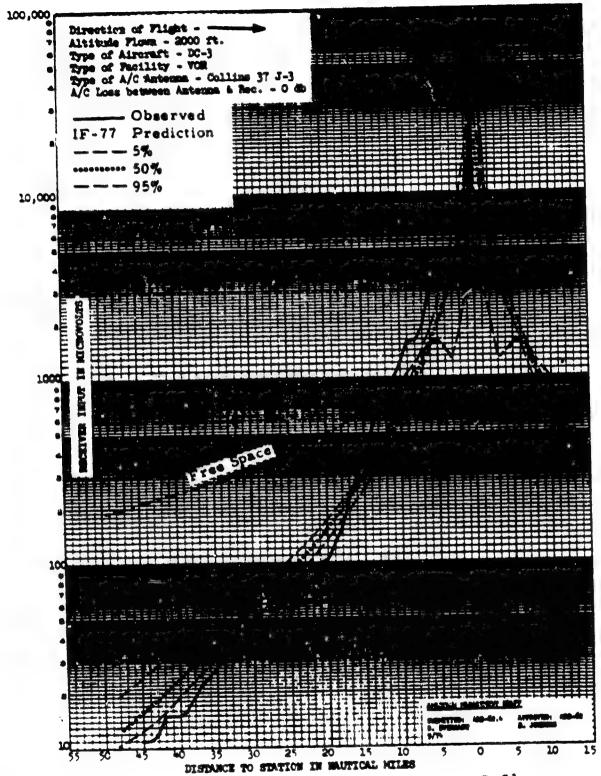


Figure 5. Path 40003, data [10, p. B-3].

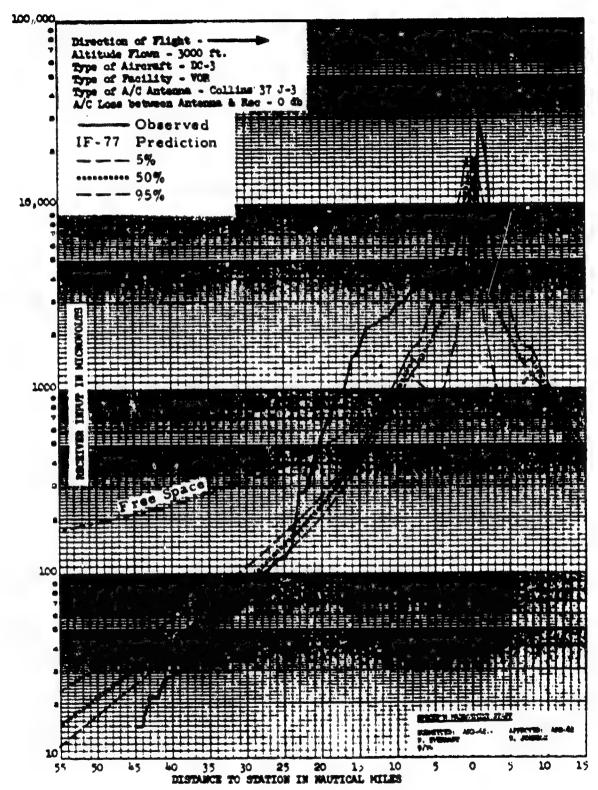


Figure 6. Path 40004, data [10, p. B-4].

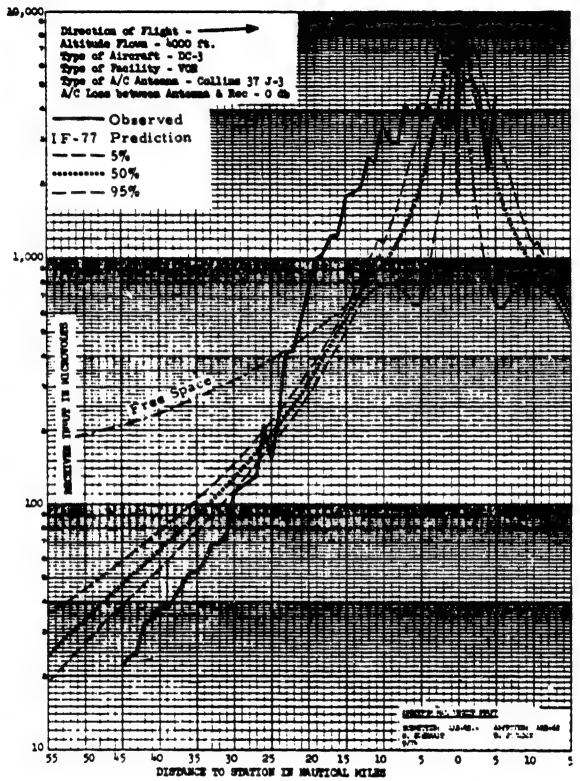


Figure 7. Path 40005, data [10, p. B-5].

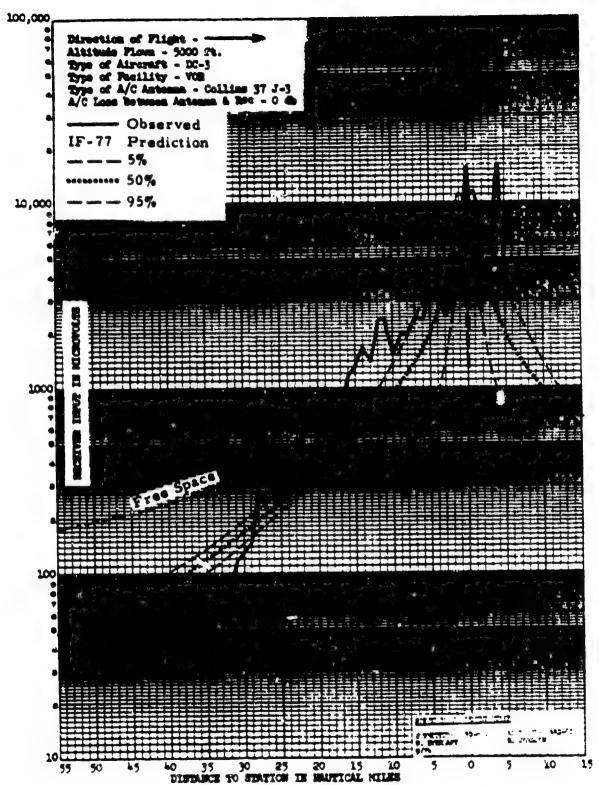


Figure 8. Path 40006, data [10, p. B-6].

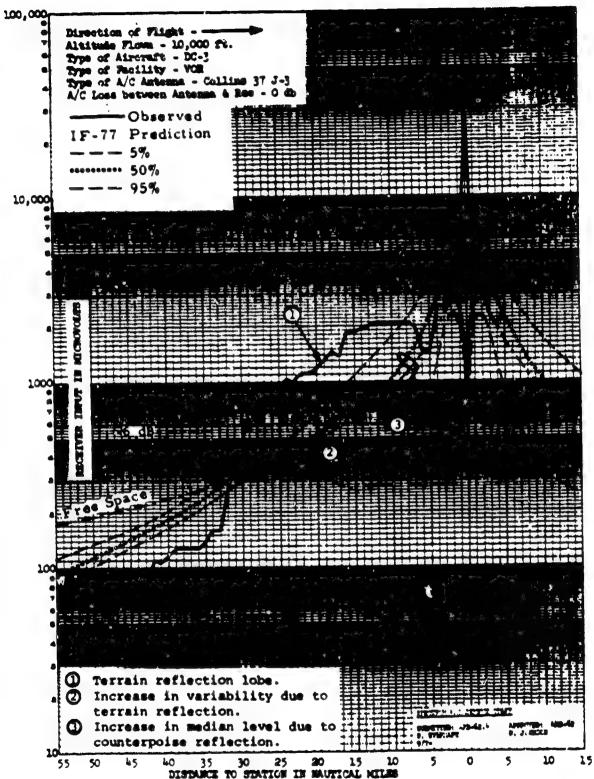


Figure 9. Path 40007, data [10, p. B-7].

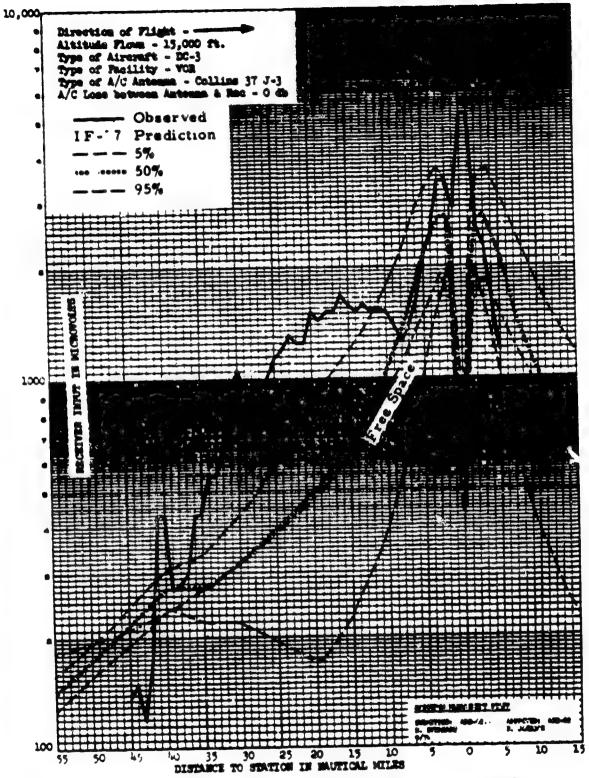


Figure 10. Path 40008, data [10, p. B-8].

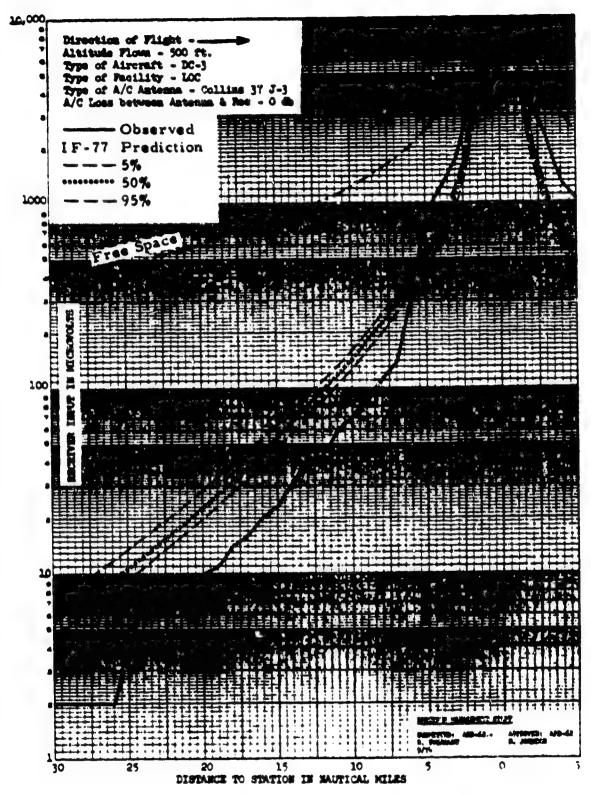


Figure 11. Path 40009, data [10, p. C-1].

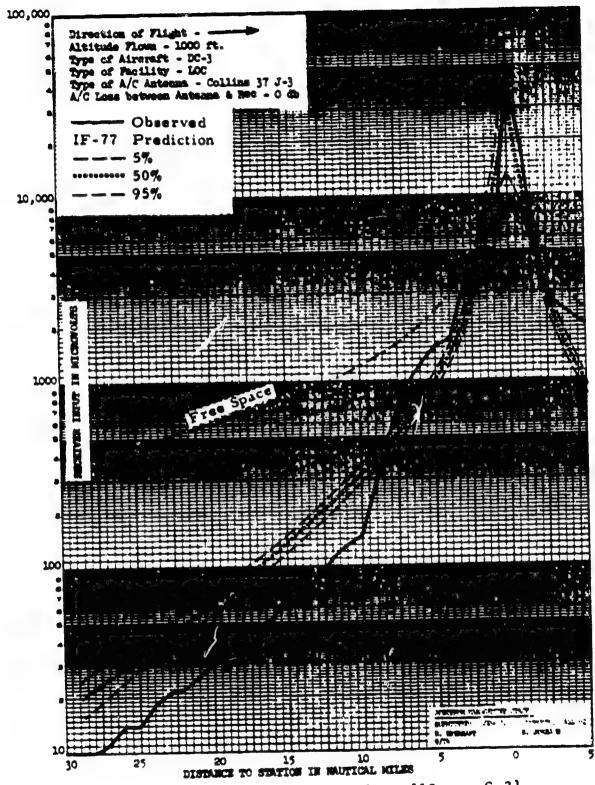


Figure 12. Path 40010, data [10, p. C-2].

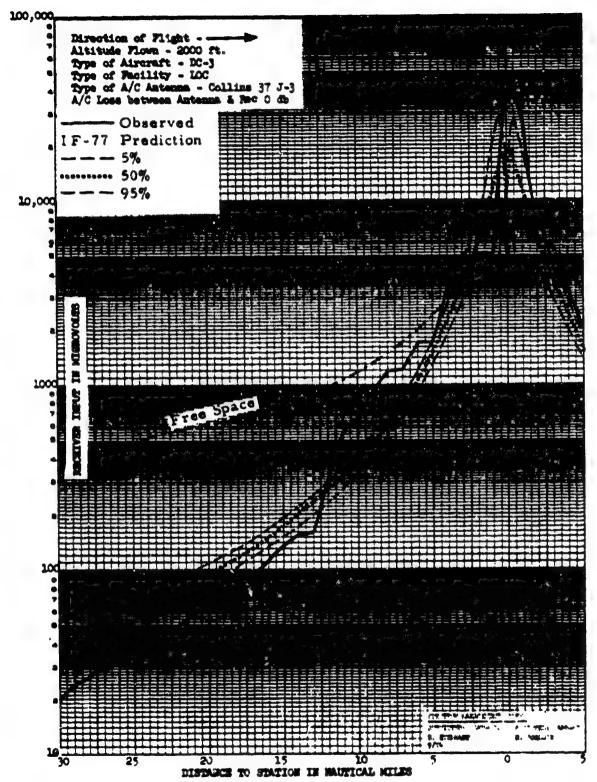


Figure 13. Path 40011, data [10, p. C-3].

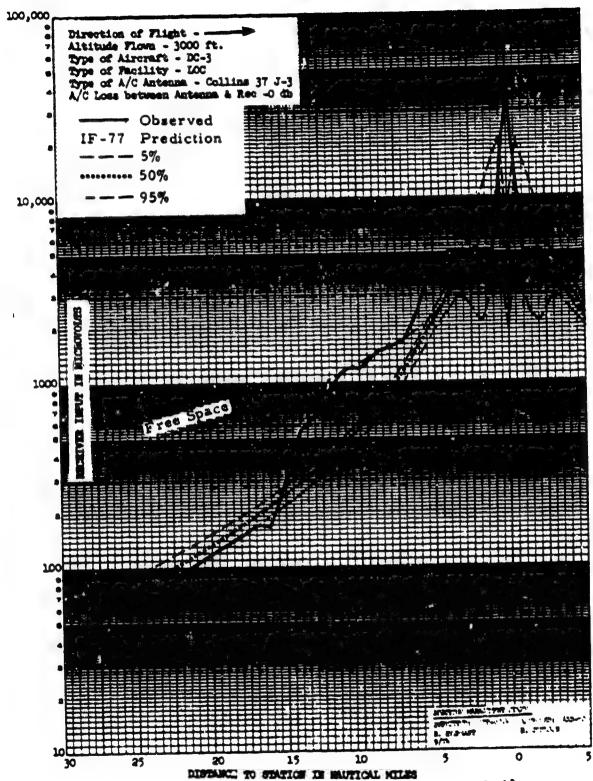


Figure 14. Path 40012, data [10, p. C-4].

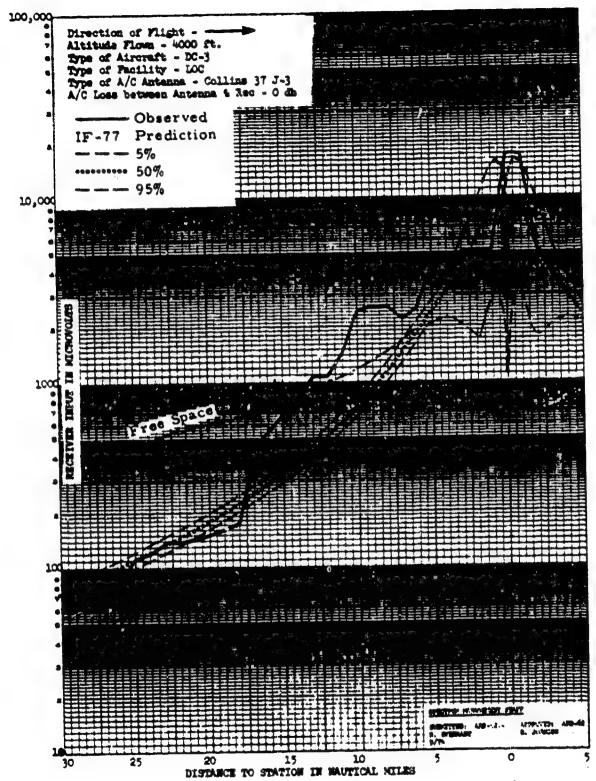


Figure 15. Path 40013, data [10, p. C-5].

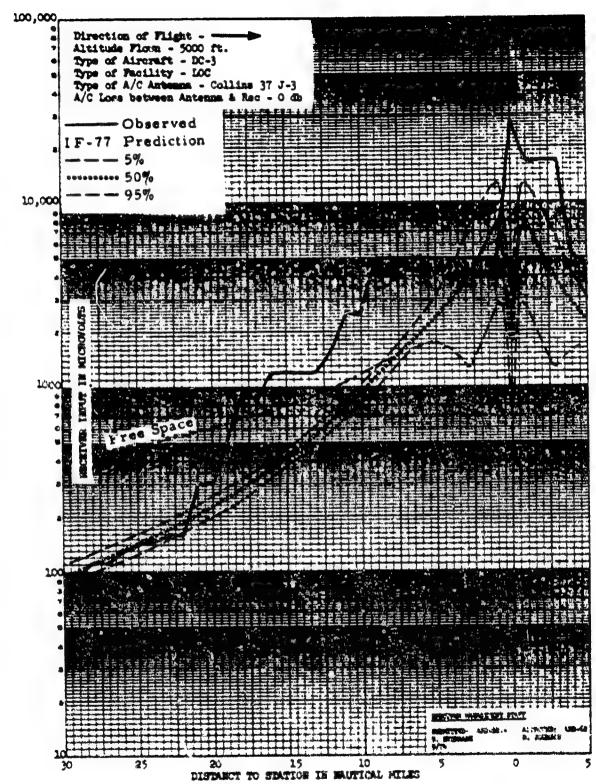


Figure 16. Path 40014, data [10, p. C-6].

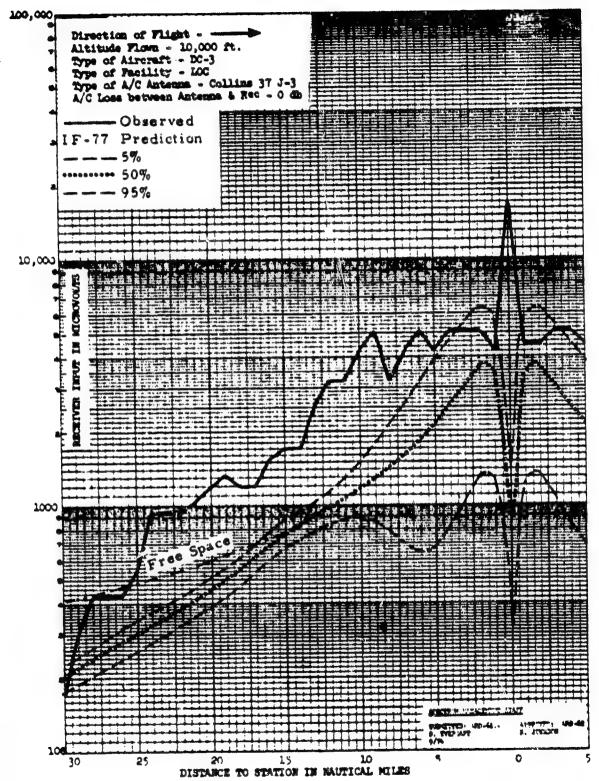


Figure 17. Path 40015, data [10, p. C-7].

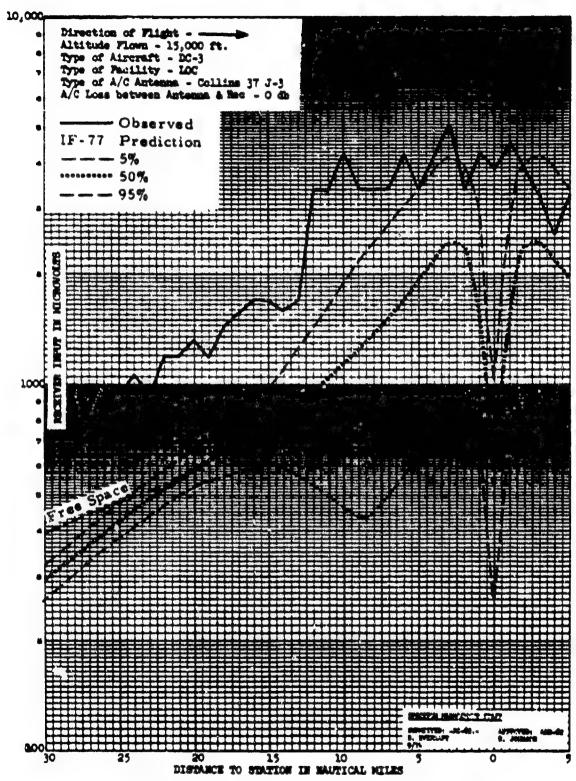


Figure 18. Path 40016, data [10, p. C-8].

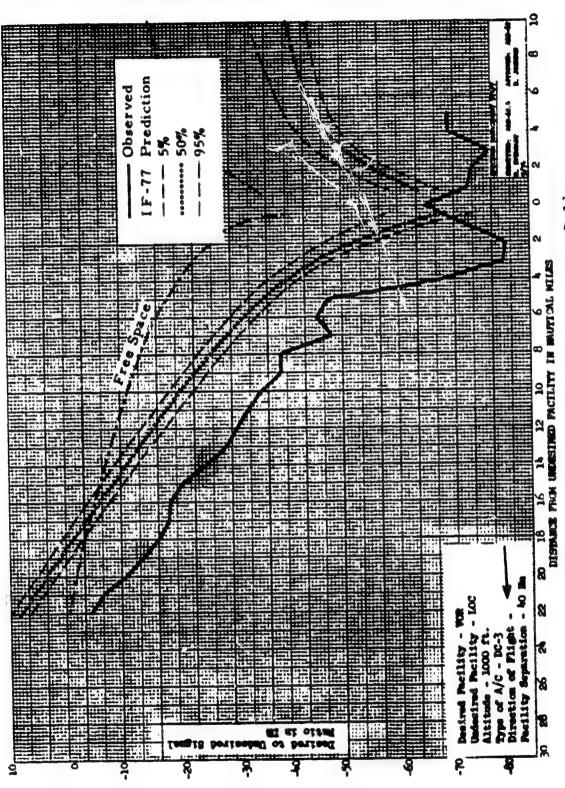


Figure 19. Path 40017, data [10, p. D-1]

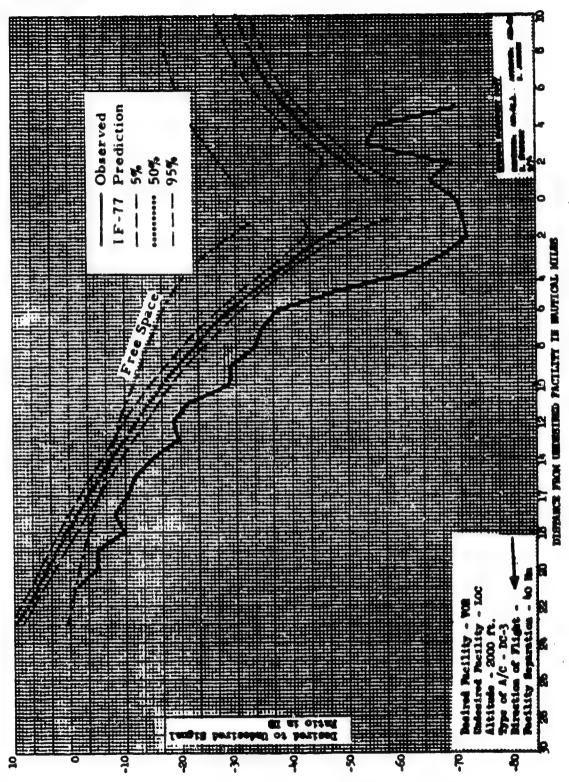


Figure 29. Path 49018, data [10, p. D-2].

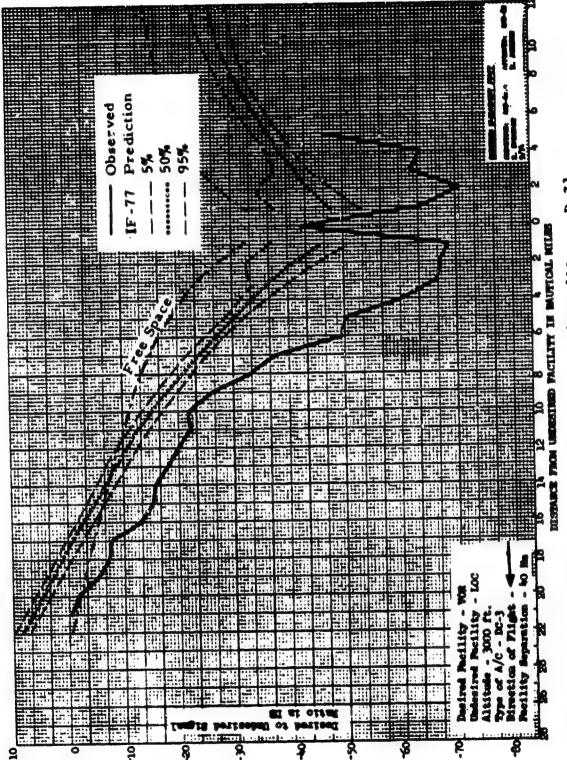


Figure 21. Path 40019, data [10, p. D-3].

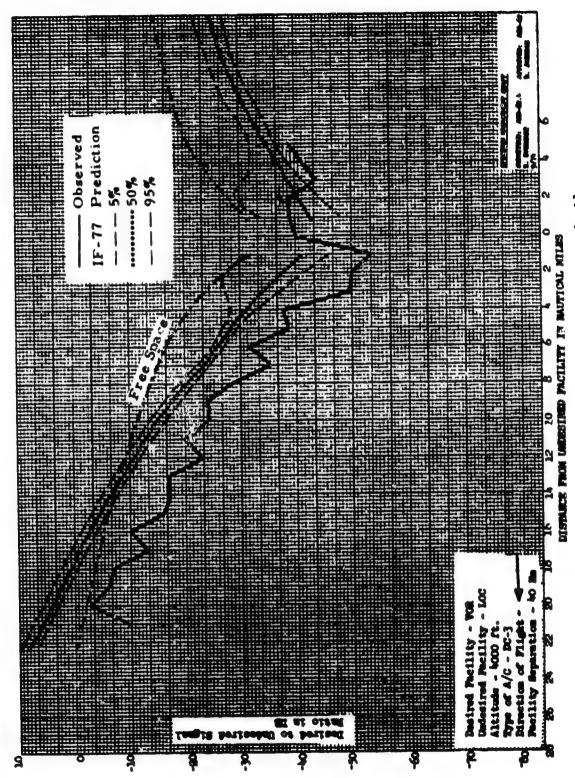


Figure 22. Path 40020, data [10, p. D-4]

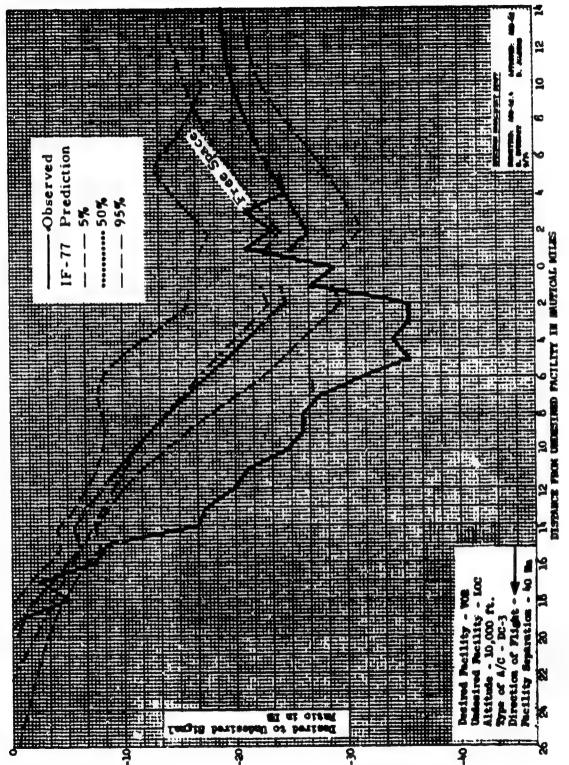
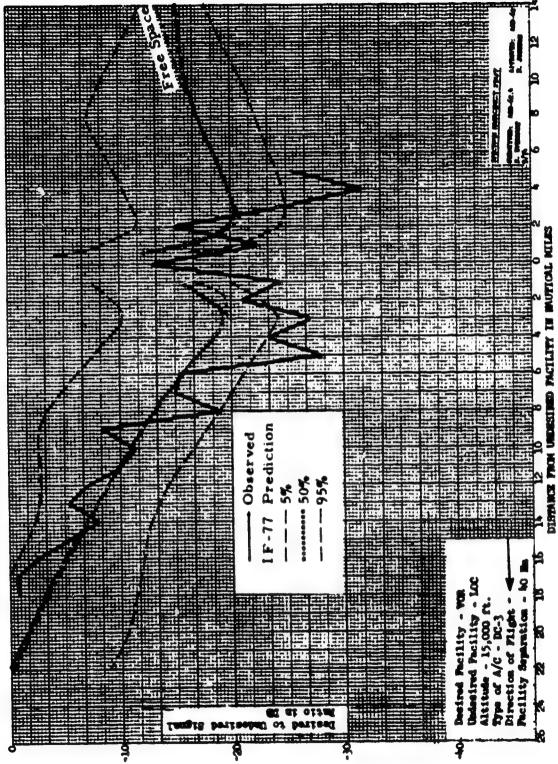


Figure 23. Path 40021, data [10, p. D-5].



The second second

Figure 24. Path 40022, data [10, p. D-6].

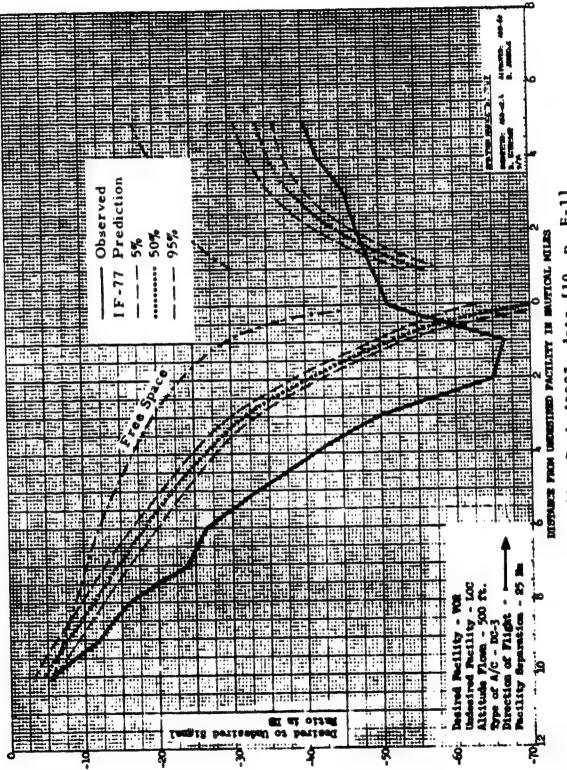
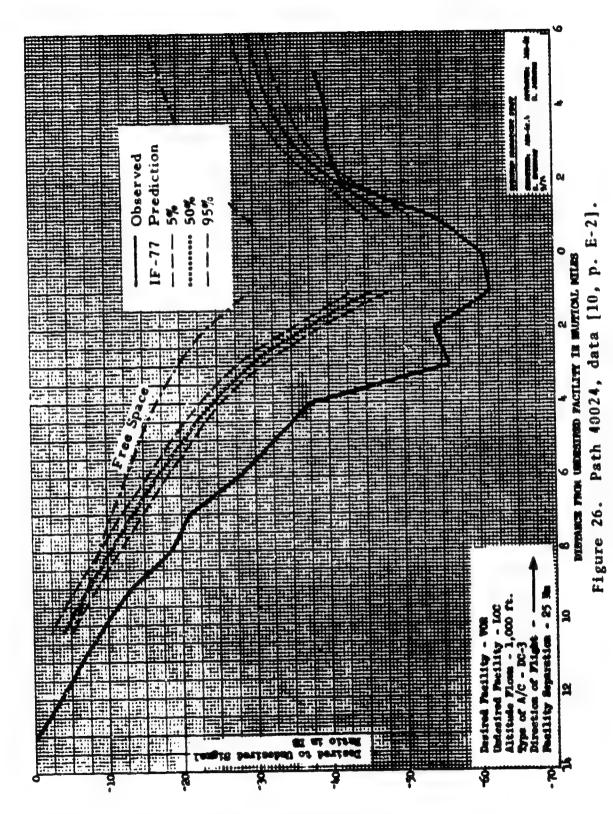
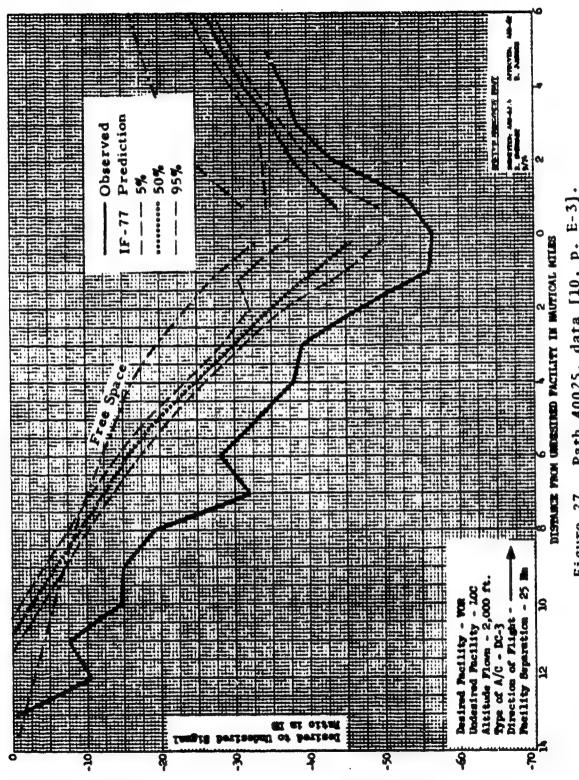


Figure 25. Path 40023, data [10, p. E-1].





Path 40025, data [10, p. 27. Figure

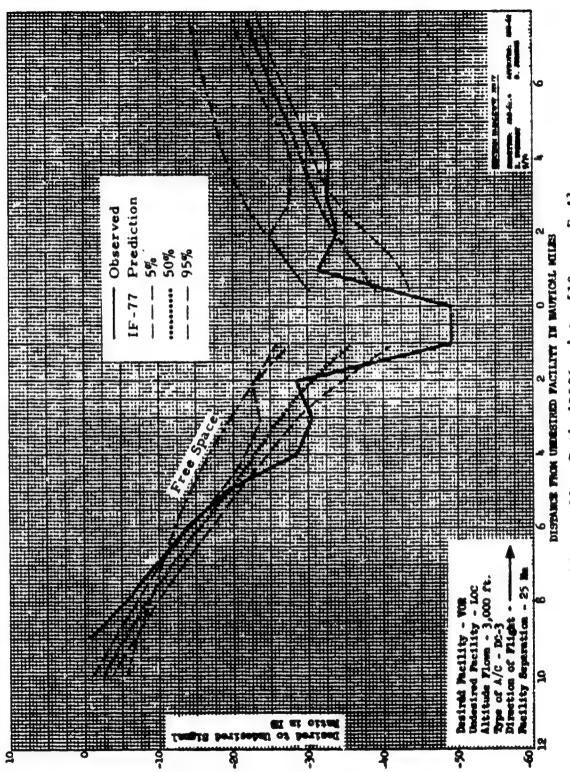


Figure 28. Path 40026, data [10, p. E-4]

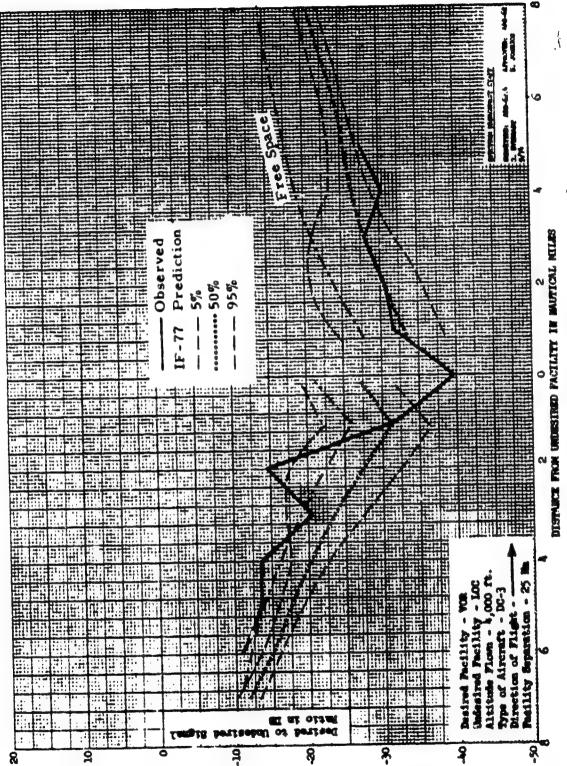
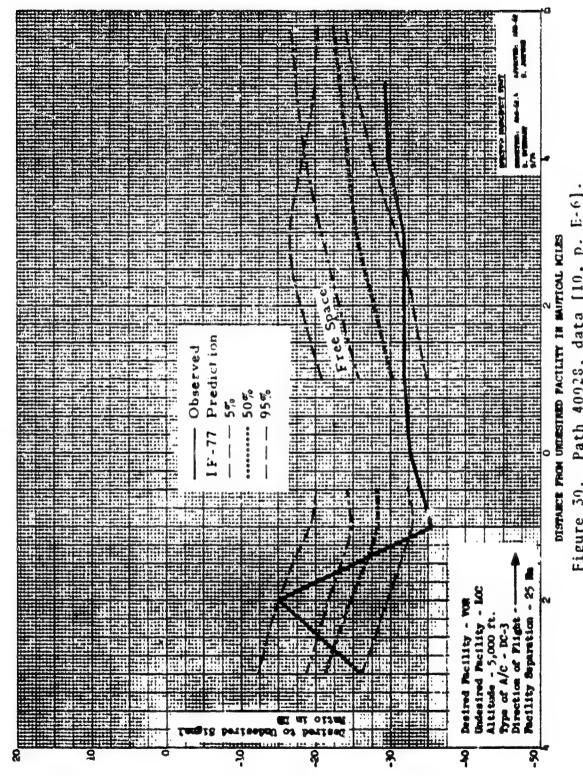


Figure 29. Path 40027, data [10, p. E-5]



Path 40928, data [10, p. E-6] Figure

4.2 MPATI DATA

Comparisons of predictions made with the IF-77 model and data [13] associated with airborne television transmission of the Midwest Program on Airborne Television Instruction (MPATI) are presented in this section. These air-to-ground transmission loss data were collected at four receiving sites for six propagation paths; i.e., Allegan (path 20001), Cleveland (paths 20002, 20003, 20004), Louisville (path 20005), and Milwaukee (path 20006). About 4130 hours of data are associated with these paths. Statistics for the difference between predicted and observed median basic transmission loss are provided in Table 6 for three propagation prediction models and four path groupings. This difference, AL, is calculated as shown in Table 3. The propagation models are IF-77, Free Space, and the OT/TREE 21 model, which were described in Table 3. Of these, OT/TREE 21 provides the best predictions for all paths except the line-of-sight paths (20004 and 20005) where IF-77 is slightly better. Free Space is the worst prediction for all paths. In terms of mean AL magnitude, [XL], the OT/TRER 21 and IF-77 predictions agree or are 1 dB apart for all groups.

Figure 31 provides comparison of median basic transmission loss distributions as measured and predicted for all six MPATI paths. Figures 32 through 41 show path profiles and parameters. These figures are grouped by path number at the end of this section as shown in the List of Figures.

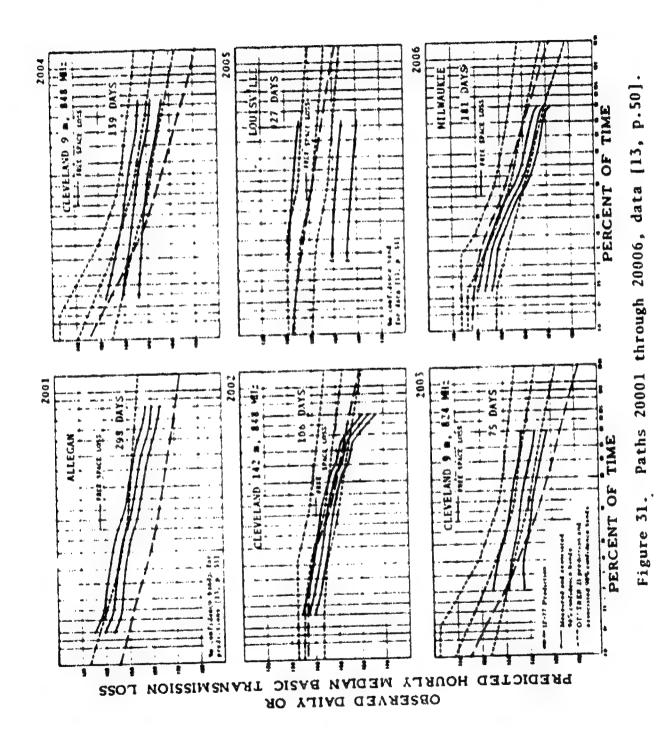


Table 6. Paths 20001 through 20006 AL Statistics

1878 - T.

Path Site Agreens Height [m]	20001 Allegan 9.8	20002 Cleveland 9. 1	20005 Cleveland 9.1	20004 Cleve3ond 142.5 848	10005 Louisville 99.1 819	2005 #11waukee 61			
rudnesca lauri				The state of the s			TT (c)	(8) (9)	MATINE!
(8)			[4P] (4) 17	[49]			(9)	69	[qp]
Tapon				-					
14 / 18 8 8 9 1			. 5.6	1.1	1.4	9.4	•	~	.10
01/ INCH 00	12.7	•	2.3	1.2	5.6.	8.9	M	•	eri era
Free Space	-12.5	24.2	.25.7	£.2	-12	-36.7	· 16	•	97.
Mit N 20001 At	With 20001 and 20005 seglected. (f)	cted. (f)							
			*	* .	•	9.7	•	2	۰
CT/TRER 21	* * * * * * * * * * * * * * * * * * * *	· · ·			•		•1	-	10
1F-77		9	7.	4 1			•	Ş	. 26
Free Space	•	-14.2	: "\$2" :	7.7	* * * * * * * * * * * * * * * * * * * *		•	2	:
The line of sight		path with 20001 and 20005 neglected. (f)	:0005 meglec	ted. ff)					
				1.2	:		-	:	
14:11 Mr /7000 31			•	1.4	:		-	:	
Free Space	:	* * * * * * * * * * * * * * * * * * * *	1 1 4 1	.4.2	•	:	•	;	•
	or the Alfertain math only with 20001 and 20005 meglected.	Alle with	20001 and 200	365 meglecte	(J) P				
THE CHILD						•	•	-	٠.
OT/TRER 21	•	F	¥.*	•	•		•		-
18-77	:	9.0	7.8	•	•	*· × ·	•	>	2 ;
Free Space	1	. 24.2	-15.7	•	* * * * * * * * * * * * * * * * * * * *	-16.7	-22	yı.	97.

(a) Models are ordered by their ability to provide good predictions for these paths with the best predictor listed first. Here, ordering is based on equal weights for LL, all, and MAX|AL!.

(b) Median basic transmission loss, i.bm. values are used to determine al.; i.e., al. " bm (predicted) bm (observed).

(c) Mean of &L.

(d) Sample standard deviation of AL.

The al value (sign included) corresponding to the naxious absolute value of &L encountered. 3

Horizon parameters for path 26001 are unknown, and line loss for path 20005 is unknown [13, Table 6].

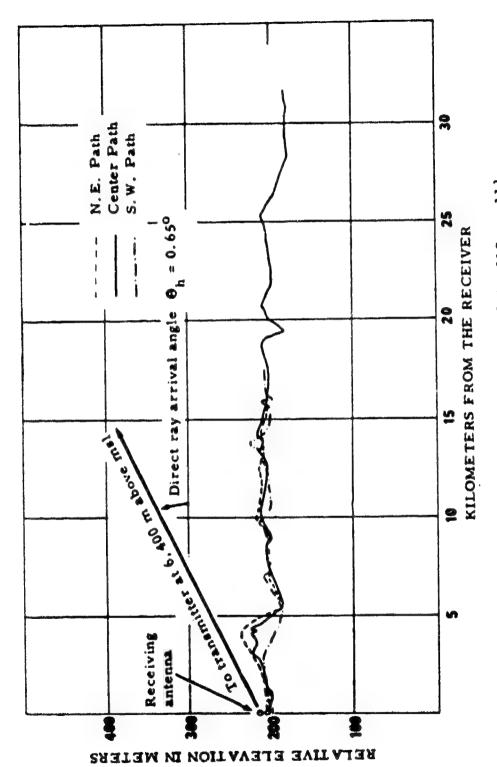
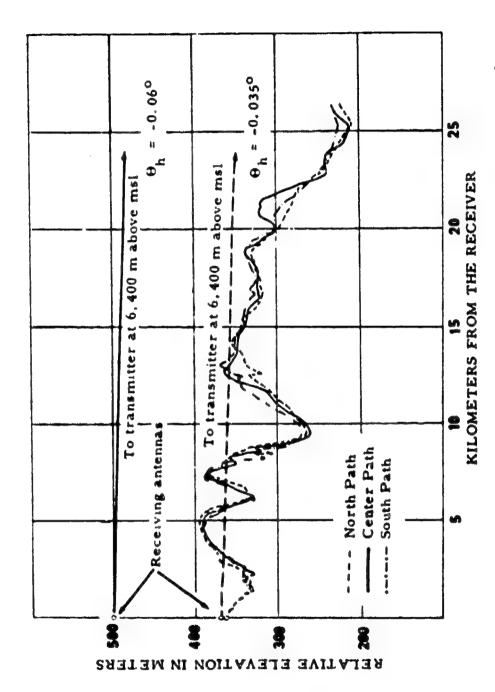


Figure 32. Path 20001, profile [13, p.11].

Path Number:	2 0 0 0	1	
Code Number: 1 1 2 8 2 1 0	6 0 1 1 0	2 1 1 1	
Location: Montpelier, Indiana - Al	Legan, Michigan		
Data type 1490 hourly medians		9 km, h _{rs} 205.7	m-ms
N 303 N-units, a 8525	km, Surface typ	e average ground	
Climate continental temperate		de 82.5	km
Frequency 824 MHz, Transmit	ter output 27.8		dBW
Δh 20 m, 6 39.7 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms]]	6400	214.8	
gain [dBi], main beam	8.7	13.6	
height [m], above site surface		9,1	
line loss [dB]			
polarization	H	K	
type		Corner Reflector	
Horizon distance [km]		0.06	
elevation [m-ms1]		217.9	
elevation angle (deg)			
Location, latitude	40°32'N	42° 36' 16"N	
longitude	85 ⁰ 17'W	85°57'23"W	
Path bearing			
elevation [m-msl]		205.7	
Other information:			

Figure 33. Path 20001, parameters [13, p. 69].



Paths 20002 through 20004, profile [13, p. 12]. Figure 34.

Path Humber:		_2	
Code Number: 1 1 2 8 2 0 0	6 1 1 1 0	2 1 1 1	
Location: Montpelier, Indiana - Cle			
Data type 695 howely medians	_, Distance <u>318</u>	6 km, hrs 356.3	m-ms 1
N 298 N-units, a 8446	km, Surface ty	average ground	
Climate continental temperate		, d <u>112.4</u>	lun
Frequency 848 MHz, Transmit	ter output 27.0	JBW, EIRP 35.2	dBW
Δh 30 m, θ 5.4 mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	6400	365.4	
gain [dBi], main beam	8.2	14.9	
height [m], above site surface		9.1	
line loss [dB]			
polarization	Н	<u> </u>	
type	1	Corner Reflector	
Horizon distance [km]		4.9	
elevation [m-ms1]		390	
elevation angle (deg)			
Location, latitude	42°32'N	41°16'50"N	
longitude	85°17°W	81°37'22"W	
Path bearing			
elevation [m-ms1]		356.3	
Other information:			

Figure 35. Path 20002, parameters [13, p. 69].

	2000		
Code Number: 1 1 2 8 2 0 0	6 0110	2 1 1 1	
Location: Montpelier, Indiana - Cle	veland, Ohio		1
Data tuna 375 houndy medians	, Distance 318	6 km, hrs 356.3	m-ms l
H 298 N-units a 8446	km, Surface typ	e average ground	
Climber continental temperate		de 112.4	km
Frequency 824 MHz, Transmitt	er output 27.8	dBW, EIRP36.5	dBW
Δh 30 m. θ 5.4 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	6400	365,4	
gain [dBi], main beam	8.7	14.0	
height [m], above site surface		9.1	
line loss [dB]	to any programmy age many state and any programmy and the state of the		
polarization	н	<u> </u>	
type		Corner Reflector	
Horizon distance [km]		4.9	
elevation [m-ms1]		390	
elevation angle [deg]			
Location, latitude	42° 32' N	41°16'50"N	
longitude	85°17'W	81°37°22"W	
Path bearing			
elevation [m-ms]]		356.3	
Other information:			

Figure 36. Path 20003, parameters [13, p. 69].

Path Number:	<u> 2 0 0 0</u>		
Code Number: 1 1 2 8 1 0 0	6 0 1 1 0	2 8 1 1	
Location: Montpelier, Indiana - Cle	veland, Ohio		
Data type 530 hourly medians	_, Distance <u>318</u>	.6 km, h, 356.3	m-ms 1
N 298 N-units, a 8446	km, Surface ty	pe average ground	
Climate continental temperate		. de 101.9	km
Frequency 848 MHz, Transmitte	er output 27.0	dBW, EIRP 35.2	M8P
Δh 30 m, θ -5.6 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	6400	498.6	
gain [dBi], main beam	8.2	14.6	
height [m], above site surface		142.3	
line loss (dB)	Н	Н	
polarization		Corner Reflector	
type		4.9	
Horizon distance [km]		390	
elevation [m-msl]	Annual Control of the	, , , , , , , , , , , , , , , , , , ,	
elevation angle [deg]	100000	41°16'50"N	
Location, latitude	42°32'N	81° 37' 22"W	
longitude	85°17°W	81 37 22 W	
Path bearing			
elevation [m-ms1]		356.3	
Other information:			

Figure 37. Path 20004, parameters [13, p. 69].

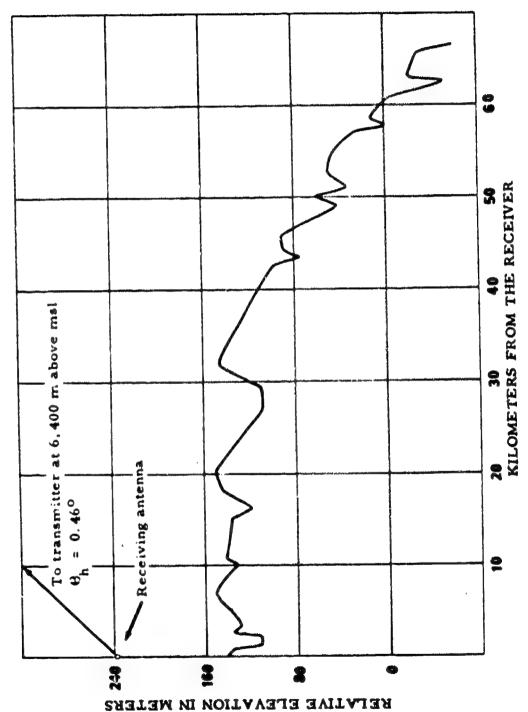


Figure 38. Path 20005, profile [13, p. 13].

Path Number:	2 0 0 0	5		
Code Number: 1 1 2 8 1 0 0	6 0 1 1 0	2 8 1 1		
Location: Montpelier, Indiana - Lou	iisville, Kentucky	1		
Data type 135 howrly medians	_, Distance <u>257.</u>	5 km, h _{rs}	138.7	m-ms 1
N 305 N-units, a 8541	km, Surface typ	e average gro	und	
Climate continental temperate		d_ 82.8		km
Frequency 824 MHz, Transmitt	er output 27.8	dBW, EIRP	36.5	daw
Δh 10 m, θ -12.5 mr.				
	Transmitter	Receiver	•	
Antenna elevation [m-msl]	6400	237.8		
gain (dBi), main beam	8.7	13,9		
height [m], above site surface		99.1		
line loss [dB]	Н	Н		
polarization		Corner Refl	ector	
type				
Horizon distance [km]				
elevation [m-msl]				
elevation angle [deg]				
Location, latitude	40°32'N	38°14'50"N		
longitude	85°17'W	85°45'50"W		
Path bearing				
elevation [m-ms]]		138.7		
Other Information:				

Figure 39. Path 20005, parameters [13, p. 69].

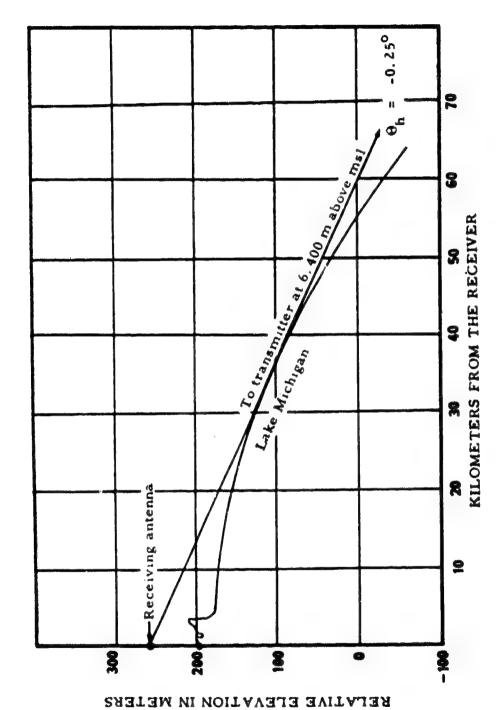


Figure 40. Path 20006, profile [15, p. 14].

Path Number:	_ 2 0 0 0	. <u>6</u>	•
Code Number: 1 1 2 8 1 0 0	6 0 1 1 0	2 8 1 1	
Location: Montpelier, Indiana - Mili	waukee, Wisconsi	n	
Data type 905 nourly medians	, Distance 357	km, h _{rs} 176.8	m-ms 1
N 304 N-units, a 8541	_km, Surface ty	pe fresh water	
Climate continental temperate		م <u>118.2</u>	km
Frequency 848 MHz, Transmitte	er output 27.0	dBW, EIRP35.2	dBW
Δh 0 m, θ 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	6400	259.1	
gain [dBi], main beam	8.2	12.5	
height [m], above site surface	E	61	
line loss [dB]	Н	Н	
polarization	The said of Print the approximation and a substitute control of the constitution of th	Corner Reflector	
type		319.8	
Horizon distance [km]		176.8	
elevation [m-msl]	p-agenty-pro-oriental-delica and analysis of the comment	the region of the region of the restrict of the restrict of the region o	
elevation angle [deg]	42°32'N	43°05'24"N	
Location, latitude	85°17'W	87°54'07"W	
longitude	85 17 W	81 J4 U1 W	
Path bearing		198.1	
elevation [m-ms1]		170.1	
Other information:			

Figure 41. Path 20006, parameters [13, p. 69].

Table 7. Paths 10031 through 12446 AL Statistics

Model ^(a)	Λ1.(b)	σ _{ΔΙ.} (c)	MAX ΔL (d)	Path(e)
	[dB]	[dB]	(dB)	No.
		All 181	Paths (f)	
ESSA 1970	- 3	8	-34	11998
IF-77	- 5	9	-32	11978
TN 101	- 7	9	-33	12350
Free Space	-36	26	-96	10260
		The 77 line	of-sight paths-	
ESSA 1970	0	8	21	10299
1F-77	- 6	8	-32	11978
TN 101	-12	10	-33	12350
Free Space	-12	9	-32	11978
	Th	e 104 beyond	the-horizon path	18:
TN 101	- 4	7	-22	12179
IE-77	- 5	9	-30	11998
ESSA 1970	- 5	7	-34	11998
Free Space	- 5	19	-96	10260

⁽a) Models are ordered by their ability to provide good predictions for these paths with the best predictor listed first. Here, ordering is based on equal weights for ΔL , $\sigma_{\Delta L}$, and MAX $|\Delta L|$.

⁽b) Difference between predicted and observed median basic transmission loss (Table 3). The mean AL is AL.

⁽c) Sample standard deviation of AL.

The ΔL value (sign included) corresponding to the maximum absolute value of ΔL encountered. This statistic picks out the worst ΔL 's encountered. They may indicate poor data as well as plor predictions or simply that the model was not appropriate for the path; e.g., Free Space for beyond-the-horizon paths.

⁽e) The path number for the path with MAX: AL |.

⁽f) Of the 202 paths for which predictions were made, only 181 could be used in this analysis since 21 do not have values for $L_{\rm hm}$ (observed).

4.3 OT/TRER 16 DATA

Comparisons of predictions made with the IF-77 model and data from DOC Report OT/TRER 16 are given in this section. Transmission loss measurements for nearly 800 point-to-point tropospheric radio propagation paths are summarized in OT/TRER 16 [25]. Many of these are not suitable for comparison with predictions made with the IF-77 model since the IF-77 model is not applicable to paths with two horizons formed by irregular terrain (Sec. 3). However, the 202 paths presented here were found to have parameters appropriate for the IF-77 model comparisons. These paths provide about 866,000 hours of data (Table 1).

Statistics for the difference between predicted and observed median basic transmission loss, ΔL , are provided in Table 7 for four propagation prediction models and three path groupings; i.e., als paths, line-of-sight paths, and beyond-the-horizon paths. The propagation models used are IF-77, ESSA 1970, Free Space, and TN 101 (Table 2), where predictions for the ESSA 1970 and TN 101 models are as provided in OT/TRER 16. Of these, ESSA 1970 provides the best predictions for all groups except the beyond-the-horizon group where TN 101 and IF-77 are slightly better. In all three groups, IF-77 is the second best predictor, and Free Space is the worst predictor. In terms of mean ΔL , the line-of-sight group has the most spread between prediction methods where $\overline{\Delta L}$ values of 0, -6, and -12 dB were obtained using the ESSA 1970, IF-77, and TN 101 models, respectively.

Figures 42 through 354 show path parameters, path profiles, and comparisons of data with predictions. Sometimes predictions made with two or more models coincide and the lines are put one on top of the other on the graphs. Frequency, f, and antenna heights, H₁, above ground are given on the profiles. The figures are grouped by path number at the end of this section, as shown in the List of Figures. Path numbers shown with the data are those of OT/TRER 16 which may be obtained by subtracting 10000 from the path number used in this report. For example,

path number 10031 used in the caption of Figure 42 corresponds to the Report OT/TRER 16 path number of 31 which is used with the data in Figure 42.

Predictions for the TN 101 and ESSA 1970 models provided with the data in OT/TRER 16 are still shown on the figures. Predictions resulting from use of the IF-77 model are shown with the data as lines of large dots (i.e.,) and designated "FAA." Marks indicating free space basic transmission loss level have been added to the data graph as a long dash(es) located in the right margin and designated "F.S." When one graph may be applicable to more than one path, F.S. is followed by a path number; i.e., F.S. 352 implies free space level for path 352 (using the OT/TRER 16 notation). If the free space level is beyond the range of the graph, the free space loss is given followed by F.S. at some arbitrary location; i.e., 152.6 dB F.S.

Some observations concerning these comparisons are as follows:

- (1) The same terrain profile may be applicable to several paths when a path parameter other than terrain is varied. For example, paths 10187 through 10191 (Figs. 52 and 55) involve a single profile and five frequencies. Other similar situations occur many times; e.g., Figures 59, 62, 66, etc.
- (2) The measured loss for the knife-edge diffraction path of Figure 174 (path 11998) seems excessive, and some conversion error in recording the data is suspected (A. G. Longley, NTIA, informal communication).
- (3) Variability about the median for the ESSA 1970 and TN 101 always agree because the TN 101 formulation was used in both predictions (Table 2). The variability for the IF-77 is usually similar because variability formulation used in it evolved from TN 101 methods, but significant

differences can occur. For example, the difference between IF-77 and TN 101 variability shown in Figure 248 occurs because the TN 101 method used is a special formulation for knife-edge diffraction paths that involves the convolution of variabilities for path segments on either side of the knife-edge [33, Sec. 10.8]. Although this more complex formulation can give better results for some specific knife-edge paths, it is no longer recommended for general application to knife-edge paths (A. G. Longley, NTIA, informal communication).

(4) The TN 101 variability formulation can predict signal levels that are too high with respect to free space, and the IF-77 formulation includes factors to avoid this difficulty [15, p. 40]. This is illustrated by the predictions shown in Figure 325.

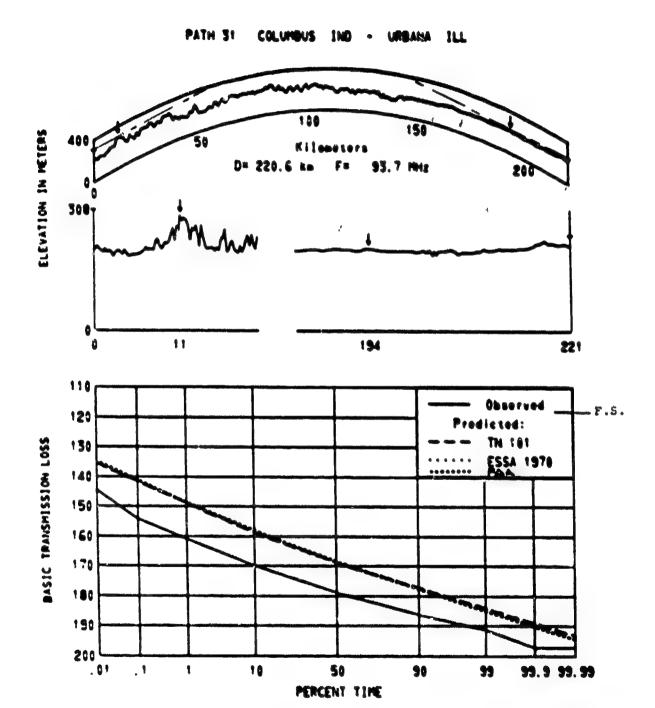


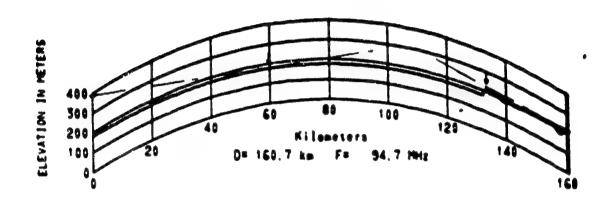
Figure 42. Path 10:31, profile and predictions.

	Path Number:	1 0 0 3		
Code Number: 1	1 2 0 3 0 0	4 5 2 1 1	2 8 1 1	
Location: C	olumbus.Indiana -	Urbana, Illinois		
Data type 1	1854 hourly medians	_, Distance	.6 km,hrs 211.5	m-m5 1
N 305	N-units, a 8557	km, Surface typ	e average ground	
Climate contin	ental temperate		de	km
	MHz, Transmitt	er output	dBW, EIRP	dBW
	n, 9mr.			
		Transmitter	Receiver	
Antenna elevatio	on [m-ms1]	307.5	246.9	
gain [dBi], ma				
height [m], al	ove site surface		27.4	
line loss [dB)			
polarization		Н	Н	
type		AND THE RESIDENCE OF THE PROPERTY OF THE PROPE		
Horizon distance	e [km]	The second secon	26.4	
elevation (m=	ms 1]	attention programme agreement and the state of the state	211.5	
elevation and	l e [deg]			
Location, latit	ude ,	39°11'05"N	40°06'39"N	
longitude		85°57'17"W	88°13'41"W	
Path bearing		bendala da represso. Han repressa estado da da das del estado da desenda estado de como en la composición de c	manufus a the confess the CON A SECTION 1 of the page 1 of the communities all his last a substitute of the page 1 of the confession and the confe	
elevation [m-	m (1)	Against Agus an agus lan cabharde - Albardet	dis der volge solge eine volgen diegendachnisse is best volgen die falle volgenders het.	
Other informati	on:			

OT/TRER 16. §ig. 3.25

Figure 43. Path 10031, parameters.

PATH 35 CHICAGO ILL - ALLEGAN MICH



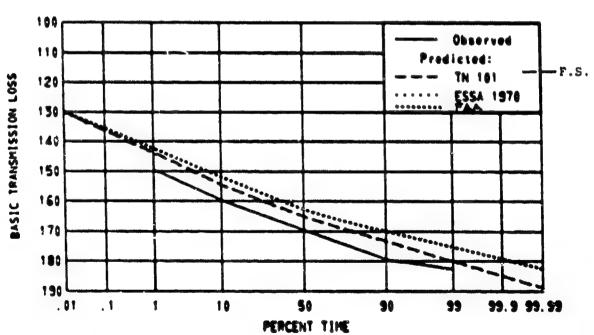


Figure 44. Path 10035, profile and predictions.

Path Number:	1 0 0 3	5 	
Code Number: $\frac{1}{1}$ $\frac{1}{2}$ $\frac{2}{0}$ $\frac{3}{3}$ $\frac{0}{0}$ $\frac{0}{0}$	AAA Minhings		τ
Location: Chicago, Illinois - A Data type 2416 hourly medians	_, Distance 160.	7 km,hrs 176.8	m-ms l
N 306 N-units, a 8574	km, Surface type	average ground	
Climate continental temperate	•	de	km
Frequency 94.7 MHz, Transmitt		dBW, EIRP	dBW
'h 18 (n, 1) mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	385.0	214.8	
gain [dBi], main beam			
height [m], above site surface		9.1	
line toss [dB]			
polarization	H	H	
type			
Horizon distance [km]		27.2	
elevation [m-ms1]	g, gar into appropria alfo, dei installo i fic. dei destino descriptiones	219.5	
elevation angle (deg)	and the state of t	co es designe designations representativo designativo della constitución della constituci	
Location, latitude	41°52'57.4"N	42° 36' 22"N	
longitude	87°38'15"W	85°57'07"W	
Path bearing elevation [m=msl]	Target in the development of the second seco	and the second of the second o	
Other information:			

Figure 45. Path 10035, parameters.

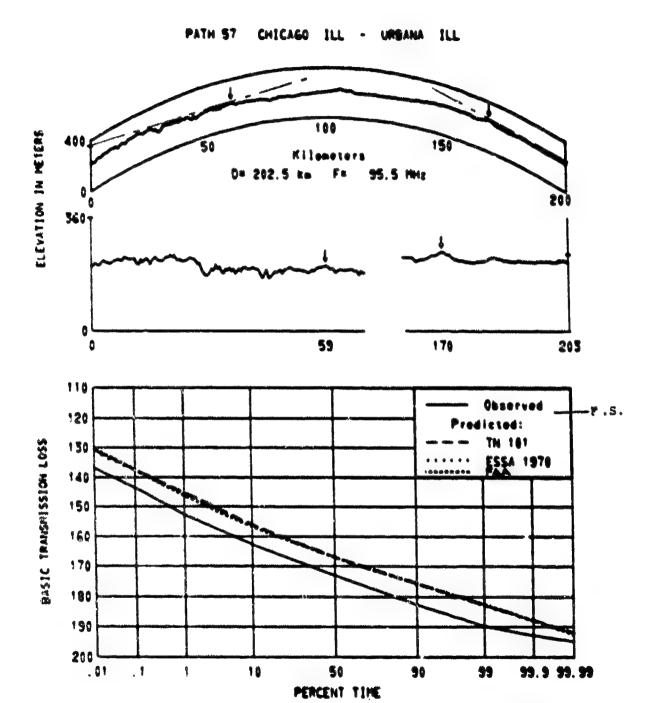


Figure 46. Path 10057, profile and predictions.

Path Number:	1005	1_	
Code Number: 1 1 2 0 3 0 0	4 5 2 1 1	2 8 1 1	
Location: Chicago, Illinois -	Urbana, Illinois		
Data type 10699 hourty median	. Distance 202.	5 km.hrs 209.	1 m-ms1
N 306 N-units, a 8574	km, Surface typ	e average ground	
Climate continental temperate	· The state of the	de	k,m
Frequency 95.5 MHz, Transmit	ter output	dBW, EIRP	dBW
th 48 m, " mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms]]	360.3	246.9	•
gain [dBi], main beam	The second secon		•
height [m], above site surface	Company of the compan	27.4	•
line loss [dB]			•
pularization	<u> </u>	<u> </u>	-
type	AND THE CONTRACTOR OF THE CONT	32.4	•
Horizon distance [km]	And the second section of the section of th	255.4	-
elevation (m-msl)		423.4	•
elevation angle [deg]	41 ⁰ 55'35"N	40°06°39"N	-
Location, latitude	88°00°22"W		-
longitude	88°00'22"W	<u> </u>	
Path bearing	and the state of t	enteren einterligund dir die, dass vongstell erligtsvelerbeiterung in der diese von einer	-
elevation [m=ms1]	arguma gerommeroponida dels sono etimologoro in negara des apprehimentos	gay gan and go at a dirt list, with Addition-Species also a magnification assessment	g-reth
Manual Indiana at history			

Figure 47. Path 10057, parameters.

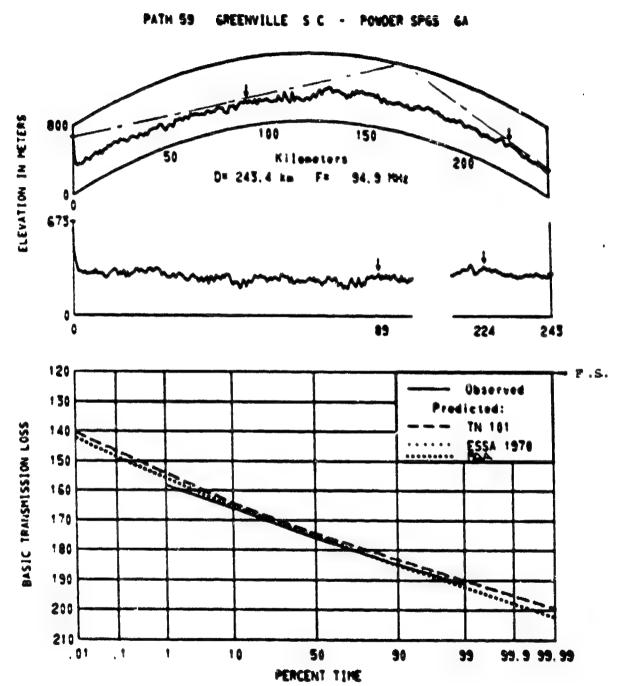
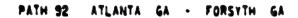
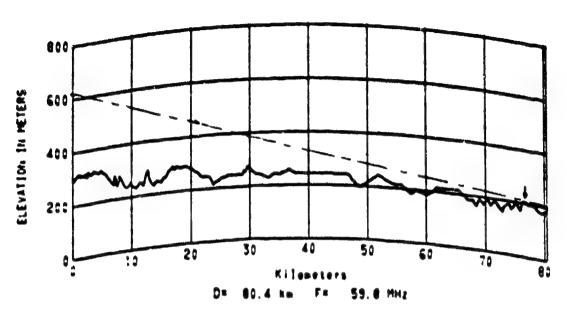


Figure 48. Path 10059, profile and predictions.

Path Number:	1005	9	
Code Number: 1 1 2 0 3 0 0	4 5 2 1 1	2211	
Location: Greenville, South Ca	rolina - Powder S	Springs, Georgia	
Data type 1820 hourly medians	, Distance 24.	3.4 km, h 300	n1
N. 302 N-units, a 8509			
Climate continental temperate		, dc	100
Frequency 94.9 MHz, Transmitt			
3h 95 m, n mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	672.7	309.3	
gain [dBi], main beam		water and the second of the se	
height [m], above site surface		9.1	
line loss [dB]		i na sana mana na mana mana mana mana man	
•	· · · · · · · · · · · · · · · · · · ·	H	
polarization		and the second s	
type		1.0.4	
Horizon distance [km]			
elevation [m-msl]	ales air dir 17 April 19 april	359.7	
elevation angle (deg)			
Location, latitude	34°56'29"N	33°52'01"N	
longitude	62024140"W	14043.12"4	
Path bearing		m and a supple commence of the latest and the supple commence of the latest and the supple commence of the latest and the late	
elevation [m-ms1]		. Baddyn in the day day was parties, or years the the department	
Other intermation:			

Figure 49. Path 10059, parameters.





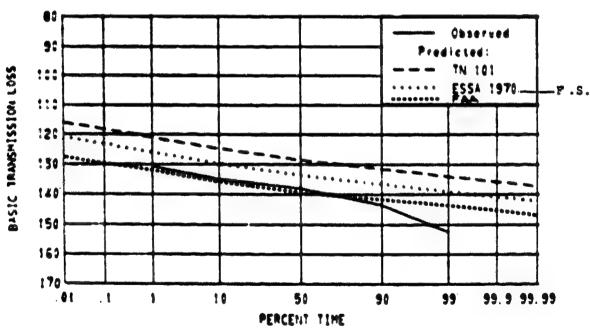


Figure 50. Path 10092, profile and predictions.

Path Number: Code Number: 1 1 2 0 2 3 C Location: Atlanta, Georgia - 1	orsyth, Georgia	2 2 1 1	m-ms 1
Data type 1212 hourly medians	, Distance	auanaga angund	
N _s 334 N-units, a 9106	km, Surface type	average ground	km
Climate continental temperate		06	
Frequency 59.8 MHz, Transmit	ter output	dBW, ETRP	"
3h 51 m, 9 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	622.4	199.6	
gain [dBi], main beam			
height [m], above site surface		9.1	
line loss (dB)			
polarization	Н	н	
•			
type	age the color of t	3.6	
Horizon distance [km]		207.3	
elevation [m-ms1]	gana may man ngindunishingkeringka ngina kapansalay ni ter uman dibanasara ana angilisang		•
elevation angle [deg]	33°45'51.8"N	33°09'11"N	
Location, latitude		83°53'48"W	
longitude	84°21'42.1"W	85 75 48 W	
Path bearing	genegatigs - deletik geller liggetigen. Sovillerstillt des tille a deletik-fillerie		
elevation [m-ms1]	arrage committee and	न्त्रे नहीं नहीं क्षात्री क्षात्री के स्थापनी के स्थापनी क्षात्री के स्थापनी	
Making Interpretions			

Figure S1. Path 10092, parameters.

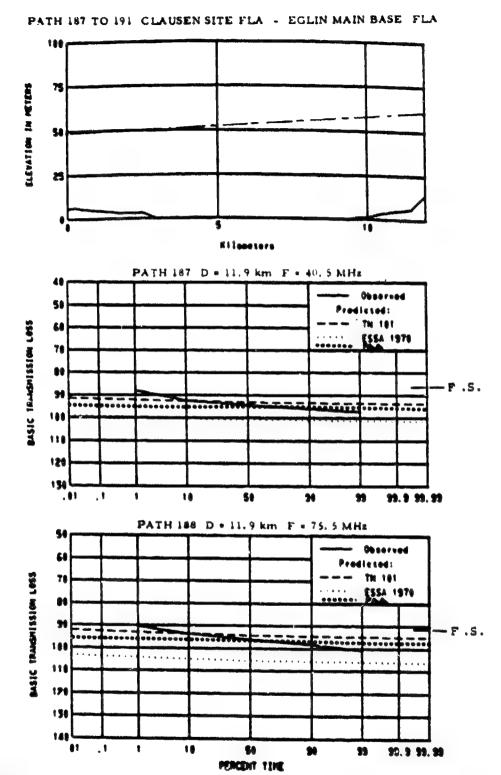


Figure 52. Paths 10187 and 10188, profile and predictions.

Path Number:	1 0 1 8	7	
Code Number: 1 1 2 0 1 0 (0 4 5 3 1 1	2 3 1 1	
Location: Clausen, Florida - I			
Data type 775 hourly medians	, Distance11.	9 km.h 0	m-ms l
N _c 330 N-units, a 9021	km, Surface ty	pe sea water	
Climate maritime temperate over			km
Frequency 40.5 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 0 .n, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	49.1	60.9	
gain [dBi], main beam			
height [m], above site surface	43.6	and the substance of the field	
line loss (dB)			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	30°23'3,3"N	30°28'33"N	
longitude	86°26'51.3"W	86°30'45"W	
Fath bearing	ellerlige- op årgereg, i redningsvistaringer om angle om endpressionete eller		
elevation [m-ms1]	appaggamps a signingsomps, associa a contributiona a stitutuda - discontributionalis.	n observable (Market Ville) in der de de de de de de la	
Attack in factors to be factors			

Figure 53. Path 10187, parameters.

Path Number: Code Number: 1 1 2 0 1 0 1 Location: Clausen, Florida - Data type 775 hourly medians N 330 N-units, a 9021	0 4 5 3 1 1 Eglin Main Base, 1 , Distance1	2 3 1 1 Florida 1.4 km.h _{rs} 0	n-m
Climate maritime temperate over			km
Frequency 75.5 MHz, Transmit			dB'₩
'th <u>0</u> m, 6 mr.			The second secon
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface line loss [dB] polarization type	1	Receiver 58.2	
Horizon distance [km] elevation [m-ms1] elevation angle [deq] Location, latitude longitude Path bearing elevation [m-ms1]	30°23'3,3"N 86°26'51.3"W	30°28'33"N 86°30'45"W	
Other information	Million on country at any on the same and a supplementary	Miller I the st. on the co-representation and approximately	

Figure 54. Path 10188, parameters.

CLAUSEN SITE FLA - EGLIN MAIN BASE FLA

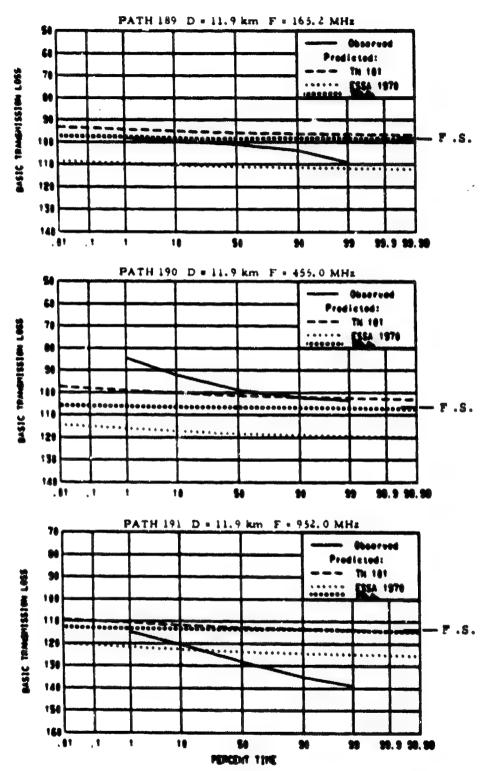


Figure 55. Paths 10189 through 10191, predictions. (see Figure 52 for profile)

Path Number: Code Number: 1 1 2 1 1 0 0 Location: Clausen, Florida - E Data type 758 hourly medians N _s 330 N-units, a 9021 Climate maritime temperate overse	iglin Main Base, F , Distance 11 km, Surface typ	2311 lorida 9 km.h _{rs} 0	
Frequency 165.2 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh <u>0</u> m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	43.0	55.4	•
gain [dBi], main beam			
height [m], above site surface	37.5		
line loss [dB]			
polarization	К	Н	
type			,
Morizon distance [km]			
elevation [m·ms1]			
elevation angle [deg]			
Location, latitude	30°23'3.3"N		
longitude	86°26'51.3"W	86°30'45"W	
Path bearing	and the second second second second	n sider sillektin varietis sillekside sija kassilja ajajamirjas on vija villimaja	
elevation [m-ms1]		and the state of t	•
Other information:			

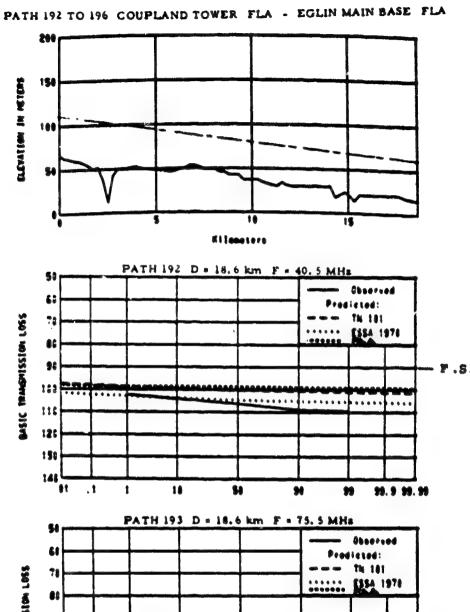
Figure 56. Path 10189, parameters.

	119		
Code Number: 1 1 2 4 1 0 0			
Location: Clausen, Florida - E	iglin Main Base, F	Lorida	
Data type 772 hourly medians			m-ms1
N ₂ 330 N-units, a 9021	km, Surface typ	e <u>sea water</u>	
Climate maritime temperate oversea		de	km
Frequency 455 MHz, Transmitt	ter output	dBW, EIRP	dBW
$\delta h = 0$ m, $\theta = mr$.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	41.5	53.9	
gain (dBi), main beam			
height [m], above site surface	36.0		
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude	30°23'3.3"N	30°28'33"N	
longitude	86°26'51.3"W	86°30'45"W	
Path bearing	and migration and a special resonance of the second		
elevation [m-msl]		s sammer on a series on began designation of same anti-collection	
Other intermation:			

Figure 57. Path 10190, parameters.

Code Number: 1 1 2 9 1 0 Location: Clausen, Florida - Data type 757 hourly medians N _S 330 N-units, a 9021	Eglin Main Base, F , Distance 11.9 km, Surface typ	2 3 1 1 Corida km,h _{rs} 0 e sea water	m-ms 1
Climate maritime temperate oversea de			km
Frequency 952 MHz, Transmit		d8W, EIRP	dBW
Ah <u>0</u> m, u mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	40.6	52.4	
gain [dBi], main beam			
height [m], above site surface	35.1		
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	30°23'3.3"N	30°28'33"N	
longitude	86°26'51.3"W	86°30'45"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 58. Path 10191, parameters.



Frocietoe:
--- th 101

Figure 59. Paths 10192 and 10193, profile and predictions.

Path Number: Code Number: 1 1 2 0 1 0 (Location: Coupland, Florida - Data type 771 hourly medians N 330 N-units, a 9021 Climate continental temperate Frequency 40.5 MHz, Transmitt	Eglin Main Base, _, Distance18km, Surface typ	2 3 1 1 Florida 6 km,h, 14.3 De average ground de	m-ms 1 km
Δh 23 m, θ mr.	er octput	GBW, EIRP	dBW
Antenna elevation [m-msl] gain [dBi], main beam	Transmitter . 110.7	Receiver 60.9	
height [m], above site surface		46.6	
line loss [dB]			
polarization	н	Н	
type			
Horizon distance [km]		18.6	
elevation (m-msl)		67.1	
elevation angle (deg)			
Location, latitude	50° 55' 29. 2"N	30°28'33"N	
longitude	86°39'10.5"W	86°30'45"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 60. Path 10192, parameters.

Path Number:	1 0 1 9	3	
Code Number: 1 1 2 0 1 0 0	4 5 2 1 1	2311	
Location: Coupland, Florida -	Eglin Main Base,	Florida	
Data type 774 hourly medians	, Distance 18	.6 km.h_ 14.3	m-ms l
N 330 N-units a 9021	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 75.5 MHz, Transmits			dBW
Δh 23 in, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	107.6	58.2	
gain [dBi], main beam			
height [m], above site surface		43.9	
line loss (dB)			
polarization	Н	Н	
type			
Horizon distance [km]		18.6	
elevation [m-ms1]		67.1	
elevation angle [deg]			
Location, latitude	30°35'29.2"N	30°28'33"N	
longitude	86°39'10.5"W	86°30'45"W	
Path bearing			
elevation [m-msl]	·		
Other information:			

Figure 61. Path 10193, parameters.

COUPLAND TOWER FLA - EGLIN MAIN BASE FLA

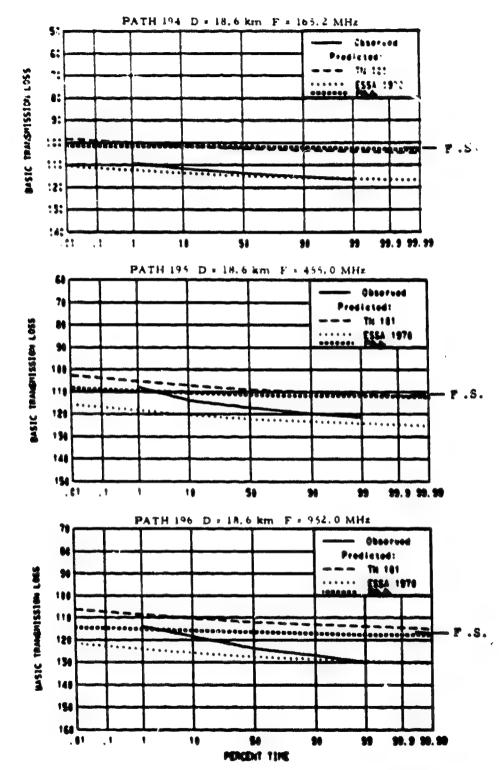


Figure 62. Paths 10194 through 10196, predictions. (see Figure 59 for profile)

	Path Number:	1 0 1 9	4	
Code Number:	1 1 2 1 1 0	0 4 5 2 1 1	2 3 1 1	
Location:	Coupland, Florida -	Eglin Main Base,	Florida	
Data type	114 hourly medians		.6 km, h 14.3	n-ms l
N 330	N-units, a9021	km, Surface typ	se average ground	
*	tinental temperate		de	km
Frequency	165.2 MHz, Transmit	ter output	dBW, EIRP	dBW
åh <u>23</u>	m, 0 mr.			
		Transmitter	Receiver	
Antenna elevat	tion [m-ms1]	104.6	55.4	
gain [dBi],	main beam			
height [m],	above site surface		41.1	
line loss [c	(Bt			
polarization	n	Н	Н	
type				
<u>Horizon</u> distan	nce [km]		18.6	
elevation [n-ms 1]		67.1	
elevation as	ngle [deg]			
Location, lati	i tude	30°35'29.2"N	30°28'33"N	
longitude		86°39'10.5"W	86 ⁰ 30'45"W	
Path bearing				
elevation [n-ms 1]			
Other informat	tion:			

Figure 63. Path 10194, parameters.

•	Path Number:	1 0 1 9	5	
Code Number:	1 1 2 4 1 0 0	4 5 2 1 1	2 3 1 1	
	Coupland, Florida -			
Data type	159 hourly medians	, Distance_18.0	6 km,h 14.3	m-ms]
M 330	N-units, a 9021	km, Surface ty	pe average ground	
Climate cor	ntinental temperate		, de	km
	MHz, Transmit			
th 23.0	mr.			
		Transmitter	Receiver	
Anterna eleva	tion [m-ms1]	103.1	53,9	
qain [dBi].	main beam			
height [m].	above site surface		39.6	
line loss [d8]			
polarizatio	n	Н		
type			n va alamiatik ediperdilikeleksi eleksiyoka dilikeniyakki egy antikhogup geyasiindilikega	
<u>Horizon</u> dista	ince [km]		18.6	
elevation (maning []	annam apaggapakkinga dimbinasikinga acam babbarakanish	67.1	
elevation a	ingle [deg]	anaky asia, alasiar k. i. as alika iki isiani (ili bila alika karasi (ilika	and the same of th	
Location, lat	itude	30° 35' 29.2"N	30°28°33"N	
longitude	•	86° 39' 10.5"W	86° 30° 45"W	
Path bearing		dendeja nagan Ago Jajik I Mori Ik Mari Jajin ini ini ini ini ini ini ini ini ini	, juda ja a a ja take dunke salkasi s sa, akke	
elevation [1 m im d 1]	agina dika upana dada upa e upa an ka vi saba s		
Other intorea	of com			

Figure 64. Path 10195, parameters.

	Path Number:	1 0 1 9	6	
Code Number:		045211		
		- Eglin Main Base,		
Data type	773 hourly median	5, Distance 18.	6 km, h 14.3	m-ms l
N 330	N-units, a 9	021 km, Surface typ	e average ground	
			de	km
Frequency 952	MHz, Transm	itter output	dBW. EIRP	dBW
	m, 0 m			
		Transmitter	Receiver	
Antenna eleva	tion [m-ms1]	102.2	52.4	
gain [dBi],	main beam			
height [m].	above site surface		38.1	
line loss [d8)	Commission of the second commission of the sec		
polarization	n	Н	Н	
type				
Horizon dista	nce [km]		18.6	
elevation [m-ms		67.1	
elevation as	ngle [deg]			
Location, lat	i tude	30° 35' 29.2"N	30°28'33"N	
longitude		86° 39' 10.5"W	86° 30' 45"W	
Path bearing				
elevation (7 - to 2 }	arriver in a state of the confliction in the state of the		
Other Internal	Linn		Affilia distribut statistic state distribution quarter say appropriate supplies, a	

Figure 65. Path 10196, parameters.

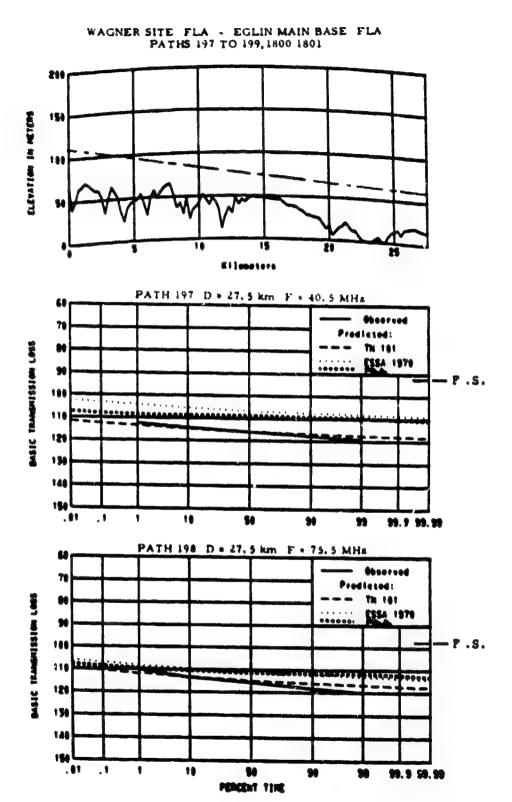


Figure 66. Paths 10197 and 10198, profile and predictions.

Path Number: Code Number:			
Location: Wagner, Florida - Eg	lin Main Base. Fl	rida	
Data type 772 hourly medians	Distance 27.	5 km.h 14.3	m-ms l
Data type //2 Nouncy measures	hm Surface tun	average ground	
N _s 330 N-units, a 9021	km, surface typ	de	km
Climate continental temperate			
Frequency 40.5 MHz, Transmitt	er output	GBW, EIKP	
th 53 m, 6 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	111.3	60.9	
gain (dBi), main beam			
height [m], above site surface		46.6	
*	MET MANAGEMENT SEQUENCE AND ADMINISTRATION ADMIN		
line loss [dB]	Н	Н	
polarization	The state of the s		
type			
Horizon distance [km]		19.6	
elevation [m-msl]	and the second s	61,	
elevation angle [deg]		0	
Location, latitude	30°40'25.5"N	30°28'33"N	
longitude	86° 80' 21"W	86°30'45"W	
Path bearing	diagrams. Jos alias alias diago tagan appropria alpo quan anomale sulli-fillia tiliatem	Appropriate to the control of the co	
elevation [mems]]			
Other information:			

Figure 67. Path 10197, parameters.

Path Number:	1 0 1 9	8	
Code Number: 1 1 2 0 1 0 1	1 4 5 2 1 1	2 3 1 1	
Location: Wagner, Florida - Egi	lin Main Base, Fl	orida	
Data type 163 hourly medians	_, Distance <u>27</u>	.5 km, h 14.3	m-ms1
N _c 330 N-units, a 9021			
Climate continental temperate		de	km
Frequency 75.5 MHz, Transmitt			dBW
3h 53 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	104.0	58.2	
gain [dBi], main beam			
height [m], above site surface		43.9	
line loss [dB]	programmed to the stand on the staff Manager and Other quiviles opens.	तः ८० वया नोन्युंक वीतः व्यवस्थात्रा व्यवस्थात्रा व्यवस्थात्रा विशेष्य व्यवस्थात्रा व्यवस्थात्रा व्यवस्थात्र	
polarization	Н	Н	
type			
Horizon distance [km]		19.6	
elevation [m-msl]		61.	
elevation angle (deg)			
Location, latitude	30°40'25.5"N	30°28°33"N	•
longitude	86°20'21"W	86°30'45"W	١
Path bearing			
elevation [n-msl]			
Other internation		The second secon	

Figure 68. Path 10198, parameters.

WAGNER SITE FLA - EGLIN MAIN BASE FLA

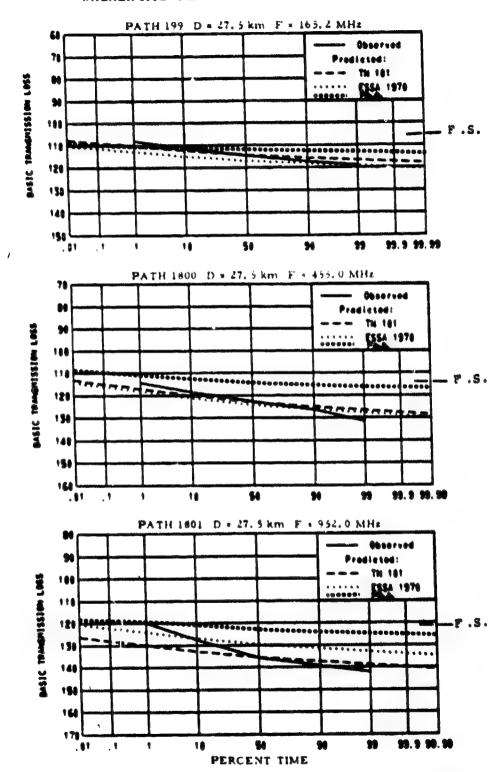


Figure 69. Paths 10199, 11800, and 11801, predictions. (see Figure 66 for profile)

Code Number: 1 1 2 1 1 0 (Location: Wagner, Florida - Eg Data type 778 hourly medians N ₅ 330 N-units, a 9021	glin Main Base, F. Distance 27.	2 3 1 1 lorida 5 km,h 14.3	m-ms1
			km'
Frequency 165.2 MHz, Transmitt	ter output	dBW, EIRP	dBW
$\Delta h = 53$ m, $\theta = mr$.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	100.9	55.4	
gain [dBi], main beam			
height [m], above site surface		41.1	
line loss [dB]			
polarization	Н	Н	
type			
<u>Morizon</u> distance [km]		19.6	
elevation [m-ms1]		61.	
elevation angle [deg]			
Location, latitude	30°40'25.5"N	30°28' 33"N	
longitude	86020121 WW	160 30 45 MM	
Path bearing			
elevation [m-ms1]			
Other information:		THE SOUND SEE AN ADDRESS OF SPECIAL PROPERTY.	

Figure 70. Path 10199, parameters.

Path Number:	_1 1 8 0 -	0_	
Code Number: 1 1 2 4 1 0 0	4 5 1 1 1	2311	
Location: Wagner, Florida - Egl	Lin Main Base, Flo	rida	
Data type 769 hourly medians	_, Distance 27.5	km,h14.3	m-ms 1
N 330 N-units, a 9021	_km, Surface type	average ground	
Climate continental temperate			
Frequency 455 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 53 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	99.4	53.9	
gain [dBi], main beam			
height [m], above site surface		39,6	•
line loss [dB]			•
polarization	Н	Н	.
type			
Horizon distance [km]		19.6	•
elevation [m-ms1]		61.	•
elevation angle [deg]			-
Location, latitude	30°40'25.5*N	30°28'33"N	-
longitude	\$6°20'21"W	86° 30' 45"W	•
Path bearing			_
elevation [m-msl]			_
Other information:			

Figure 71. Path 11800, parameters.

Path Number: Code Number: 1 1 2 9 1 0 0 Location: Wagner, Florida - Egs	4 5 2 1 1	2 3 1 1	
Data type 764 hourly medians			m=:ns1
N ₂ 330 N-units, a 9021			
Climate continental temperate		de	km
Frequency 952 MHz, Transmitt			dBW
Mh 53 m, 9 mr.			
	Transmitter	Receiver	
Antenna elevation [m=ms1]	98.2	52.4	
gain [dBi], main beam			
height [m], above site surface		38.1	
line loss [dB]			
polarization	н	н	
type			
Horizon distance [km]		19.6	
elevation [m-ms1]		61.	
elevation angle [deg]			
Location, latitude	30°40'25.5"N	30°28'33"N	
longitude	16°20'21"W	86° 30' 45"W	
Path bearing	a agai agus a san againnta malan din shir ana shirudhin da shikibi	s agust milités i titaji rapundu qu sprortungigados de dé uppredicted	
elevation [m-msl]	A COLUMN CONTRACTOR CO	design reporting to the table of the table of the table of the table of tab	
Other internation:			

Figure 72. Path 11801, parameters.

PATHS 206 210 212 TO 216,219 CHICAGO ILL - URBANA ILL

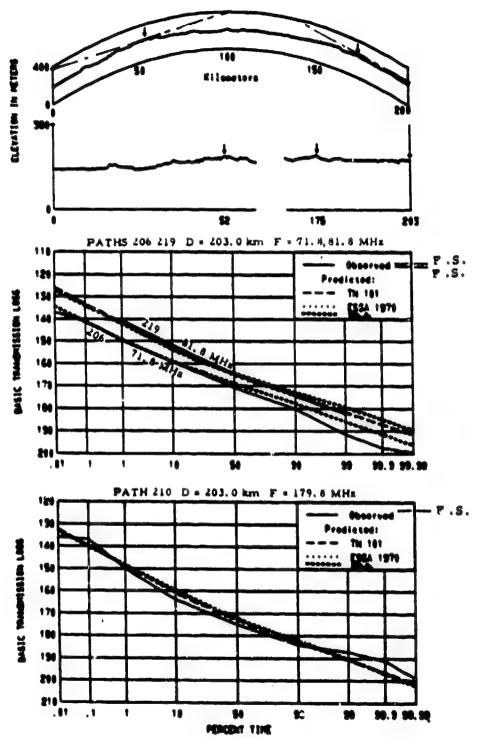


Figure 73. Paths 10206, 10219, and 10210, profile and predictions.

Path Number:	1 0 2 0	<u>6</u>	
Code Number: 1 1 2 0 3 0 0		2111	
Location: Chicago, Illinois -			
Data type 9304 hourly medians	_, Distance 203	.4 km, h 200	m-ms1
N _s 305 N-units, a 8557	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 71.8 MHz, Transmitt	er output	dBW, EIRP	dBW
Ah 36 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	380.1	246.9	
gain [dBi], main beam			
height [m], above site surface		27.4	
line loss [dB]			
polarization	Н	н	
type			
Horizon distance [km]		28.5	
elevation [m-ms1]		246.3	
elevation angle [deg]			
Location, latitude	41°53'09"N	40°06'39"N	
longitude	87°37'55"W	88°15'41"W	
Path bearing		name uplants no error returnation terror months affice destributes and	
elevation [m-ms1]		migga anglerkyllegysgapelderskiller elyktelle volumente. All ten ara sense en mystert	
Other information:			

Figure 74. Pain 10206, parameters.

Path Number:	_1 021	9	
Code Number: 1 1 2 0 3 0 0	4 5 2 1 1	2 8 1 1	
Location: Chicago, Illinois -	Urbana, Illinois		
Data type 2711 hourly medians	_, Distance <u>203</u> .	0 km,h 238.7	m-ms l
N ₂ 305 N-units, a 8557	km, Surface typ	e average ground	
Climate continental temperate			km
Frequency 81.8 MHz, Transmitt			dBW
Δh 34 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	363.7	253.0	
gain [dBi], main beam			
height [m], above site surface		33.5	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		28.5	
elevation [m-msl]		246.9	
elevation angle [deg]			
Location, latitude	41°52'57.4"N	40°06'39"N	
longitude	87°38'15"W	88°13'41"W	
Path bearing		-	
elevation [m-ms1]			
Other Informations			

Figure 75. Path 10219, parameters.

Path Number: Code Number: 1 1 2 1 3 0 Location: Chicago, Illinois -	0 4 5 2 1 1 Urbana, Illinois	2 8 1 1	
Data type 9226 hourly medians	, Distance20	3.0 km, h 200	m-ms l
N _s 305 N-units, a 8557	km, Surface ty	pe average ground	
Climate continental temperate		, de	kin
Frequency 179.8 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 36 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m=ms1]	374.0	246,9	
gain [dBi], main beam			
height [m], above site surface		27.4	
line loss [dB]			
polarization	Н		
type		н	
Horizon distance [km]	***		
elevation [m-ms1]		28.5	
· · · · · · · · · · · · · · · · · · ·		246.9	
elevation angle [deg]			
Location, latitude	41°52'57.4"N	40°06'39"N	
longitude	87°38'15"W	88°13'41"W	
Path bearing			
elevation [m-ms1]	Of the Streethoods of Propagation St. risks a retaining to State .	distinguished to the state out over requisition designation	
Other Information:			

Figure 76. Path 10210, parameters.

CHICAGO ILL - URBANA ILL

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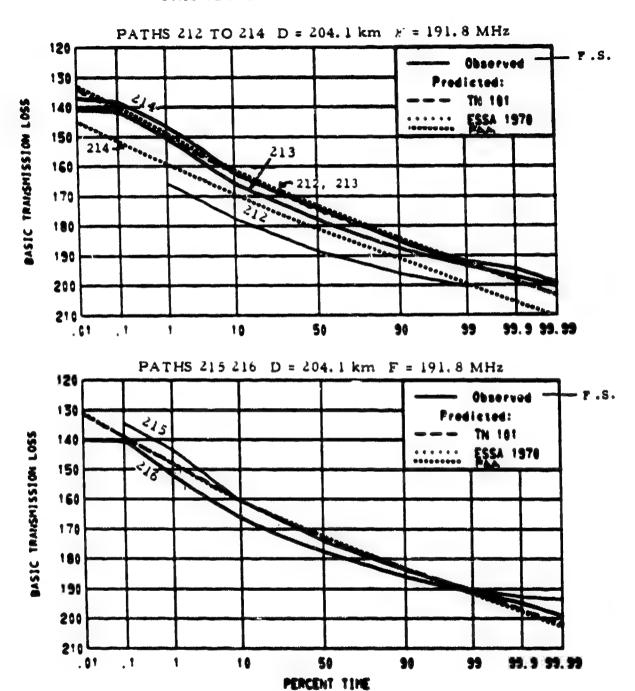


Figure 77. Paths 10212 through 10216, predictions. (see Figure 73 for profile)

Code Number: 1 1 2 1 3 0 0 Location: Chicago, Illinois - Data type 3139 hourly medians N _s 305 N-units, a 8557	Urbana, Illinois Distance <u>204</u> km, Surface ty	2 8 1 1 .1 km.h. 200 pe average ground	m-ms 1
Climate continental temperate			km
Frequency 191.8 MHz, Transmitt	ter output	dBW, EIRP	dBW
th 36 m, e mr.			
	Transaitter	Receiver	
Antenna elevation [m-ms1]	365.7	241.4	
gain [dBi], m ain bea m			
height [m], above site surface		21.9	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		28.2	
elevation [m-ms1]		245,4	
elevation angle [deq]			
Location, latitude	41°53'25"N	40°06'39"N	
longitude	87° 37 ' 25"W	88°13'41"W	
Path bearing		The state of the s	
elevation [m-ms1]		attendig (miljanen a 1900-teljäristä). Allitäiniksi kälisäätän attiininkavalandan engyyvin naja	
Ather information		der eine vertreichte der von der vertreicht der der von der vertreichte der der der vertreichte der der der der der der der der der de	

Figure 78. Path 10212, parameters.

Path Number:	1 0 2 1	3	
Code Number: 1 1 2 1 3 0 0	4 5 2 1 1	2 8 1 1	
Location: Chicago, Illinois -	Urbana, Illinois		
Data type 10787 hourly medians	, Distance 204	.1 km, h 200	m-ms l
N ₂ 305 N-units, a 8557	_km, Surface typ	e <u>average ground</u>	
Climate continental temperate		de	ikm
Frequency 191.8 MHz, Transmitt	er output	dBW, EIRP	dBW
Ah 36 m, A mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	365.7	241.4	
gain [dBi], main beam			
height [m], above site surface		21.9	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		28.2	
elevation [m-msl]		245.4	
elevation angle [deg]			
Location, latitude	41°53'25"N	40°06' 39"N	
longitude	87°37'25"W	88°13'41"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 79. Path 10213, parameters.

Path Number:			
Code Number: 1 1 2 1 3 0 0		2 8 1 1	
Location: Chicago, Illinois - W	*		
Data type 10777 hourly medians	, Distance 20	1.1 km, h 245.4	m-ms l
N 305 N-units, a 8557	km. Surface ty	pe average ground	
Climate continental temperate		de	km
Frequency 191.8 MHz, Transmitte			dBW
'h 36 m. H mr.			
	Transmitter	keceiver	
Antenna elevation [m-ms1]	365.7	249.4	
gain [dBi], main beam			
height [m], above site surface		29.9	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		28.2	
elevation [m-msl]		245.4	
elevation angle [deg]			
Location, latitude	41°53'25"N	40°06' 39"N	
lungitude	87 ⁰ 37'25"W	88°13'41"W	
Path bearing			
elevation [m-ms1]	•		
Other Information:		state 4 th court on Magnetal s to the abbitrations	

Figure 80. Path 10214, parameters.

Path Number:	1 0 2 1	5	
Code Number: 1 1 2 1 3 0 0	4 5 2 1 1	2 8 1 1	
Location: Chicago, Illinois -			
Data type 9831 hourly medians	, Distance204	.1 km, h 200	m-ms1
N _s 305 N-units, a 8557	km, Surface typ	e average ground	
Climate continental temperate		, de	km
Frequency 191.8 MHz, Transmit	ter output	dBW, EIRP	dBW
$\Delta h = 36$ m, $\theta = mr$.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	365.7	257	
gain (dBi), main beam			
height [m], above site surface		37.5	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		28.9	
elevation [m-ms]]		246.3	
elevation angle [deg]			
Location, latitude	41°53'25"N	40°06'39"N	
longitude	87°37'25"W	88°13'41"W	
Path bearing		ngagan son a su unu na vagyrtan ngifur noonilijahidadanianside silika e de dilik ed	
elevation [m-msl]	AND SHEW MINISTER SHEW SHEW SHEW SHEW SHEW SHEW SHEW SHEW	during region as in as in the day distributed as the red and a health light light of	
Other Informations			

Figure 81. Path 10215, parameters.

	Path Number:	1 0 2 1	6	
Code Number:	1 1 2 1 3 0 0	4 5 2 1 1	2 8 1 1	
	Chicago, Illinois -			
Data type	10152 hourly medians	, Distance 204	1.1 km,h 200	m-ms1
	N-units, a <u>8557</u>			
	inental temperate			kni
	MHz, Transmitt			dBW
\h 36	m, 0 mr.			
		Transmitter	Receiver	
Antenna elevat	tion [m-ms1]	365.7	241.4	
gain [dBi],	main beam			
height [m].	above site surface		21.9	
line loss (d 8]			
polarizatio	n	Н	Н	
type		by processing the same of the	apalgadiji ralinis, ajbrihar-par-panihary - nin gililiya hdisiyadisi k	
Horizon dista	nce [km]		28.2	
elevation (m=ms 1]		245.4	
elevation a	ngle [deg]			
Location, lat	i tude	41°53'25"N	40°06'39"N	
longitude		87°37'25"W	88 ⁰ 13'41"W	
Path bearing		million references in a decrease as there is no in the band.	analesanes e a relation e necessar relations e es sector e se	
elevation (1 1. 1 }	·	to opens, for a respective to a rate of the state of the	
Other informa	tion:			

Figure 82. Path 10216, parameters.

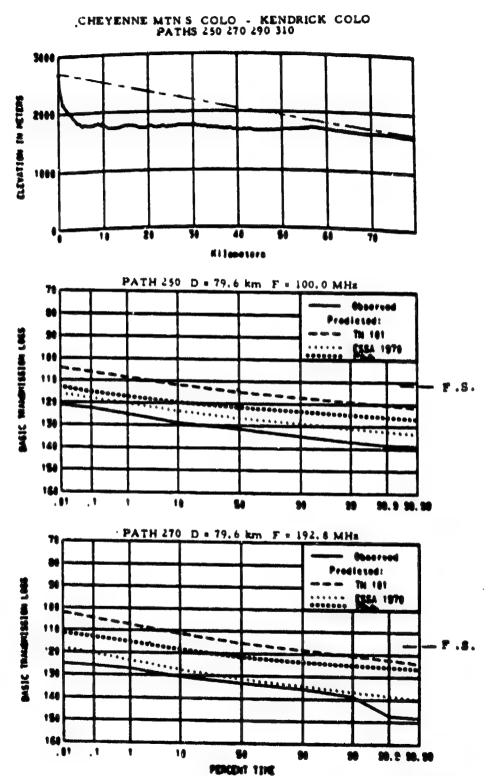


Figure 83. Paths 10250 and 10270, profile and predictions.

	Path Number:	1 0 2 5	0	
Code Number:	1 1 2 1 1 0			
	Cheyenne Mountain S			
	9628 hourly medians			m-ms1
N 248	N-units, a 782	6 km, Surface typ	e average ground	
	itinental temperate			km
Frequency 1	00.0 MHz, Transmi	tter output	dBW, ETRP	qRM.
Ah 116	m _e 0 mr	•		
		Transmitter	Receiver	
Antenna eleva	ition [m-ms1]	2683.8	1609	
gain [dBi],	main beam			
height [m].	above site surface	an emailteire - Wir annahl in Geologia - Grod - san t-Mercal t-Mercal - Mercal	en-man egyan - maja sama iganaga nagan kanaga - mit i an is si si samati di sidab	
line loss (dB)			
polarizatio	on	<u> </u>	Н	
type				
<u>Horizon</u> dista	ince [km]		79.6	
elevation ([m-m51]		2667.	
elevation a	angle [deg]	a agreement and an other contracts of the contracts of the contracts of the contract of the co	comments of the comments of th	
Location, lat	titude	38°45'50.4"N	38°34'08.4"N	
longitude		104°51'50.4"W	103°59'02.4"W	
Path bearing		a ngon ganggaran ajan dan bay dan da ba samalikan darakinadari	Could be a reliable to the other to the settle of the sett	
elevation	[*** = 148 4"]]	wage-date recoverage & a storm over the 4 tests with the	dag dysins design i se kalajon kajo ki pinte gammanisten had	
Other informa	ation:			

Figure 84. Path 10250, parameters.

	Path Number:	1027	0	•
Code Number:	1 1 2 1 1 0	0 4 5 2 1 1	2 8 1 1	
Location:	Cheyenne Mountain	Summit, Colorado -	Kendrick, Colorado	
Data type	5835 hourly median	b , Distance 79	.6 km,h 1603	m-ms i
N_ 248	N-units, a 7826	km, Surface typ	e average ground	
Climate cont	inental temperate		de	km
Frequency 192.	8 MHz, Transmi	ter output	dBW, EIRP	dBW
	m, 0 mr			
		Transmitter	Receiver	
Antenna eleva	tion [m-ms1]	2699	1608.7	
gain [dBi],	main beam			
height [m].	above site surface		5.7	
line loss (d	(8)			
polarization	1	Н	Н	
type				
Horizon distan	nce [km]		79.6	
elevation (r	n-ms1]		2667.	
elevation as	ngle [deg]			
Location, lati	tude	38°45'50.4"N	38 ⁰ 34'08.4"N	
long i t ude		104°51'50.4"W	103°59'02.4"W	
Path bearing				
elevation (n-ms 1]			
Other informat	tion:			

Figure 85. Path 10270, parameters.

CHEYENNE MTN S COLO - KENDRICK COLO

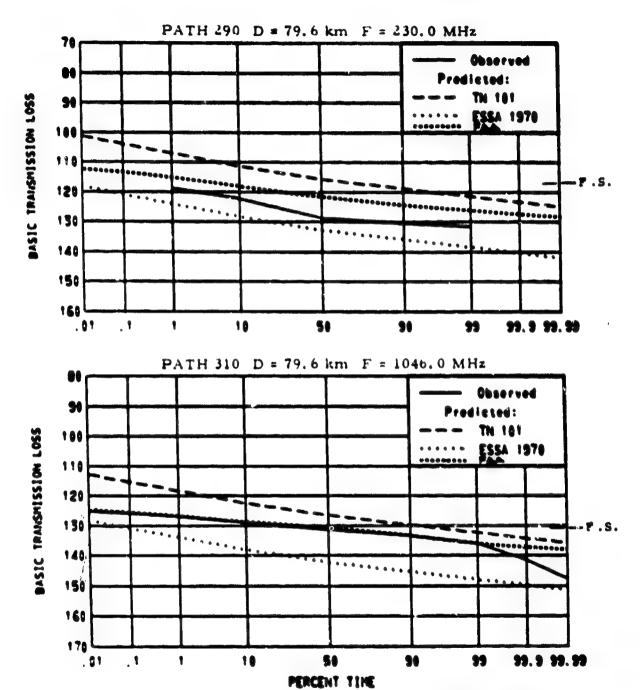


Figure 86. Paths 10290 and 10310, predictions. (see Figure 83 for profile)

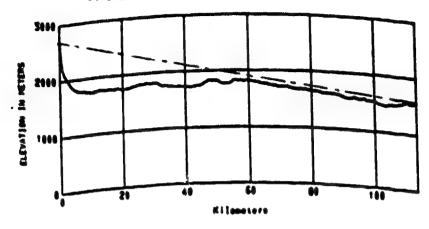
Code Number: 1 1 2 2 1 0 0 Location: Cheyenne Mountain Sum Data type 1024 hourly median	mit, Colorado - K . Distance 79.	2 8 1 1 endrick, Colorado 6 km.h. 1603	m-ms 1
N 248 N-units, a 7826	km, Surface typ	e average ground	
Climate continental temperate			km
Frequency 230 MHz, Transmitt	ter output	dBW, EIRP	dBW
Δh 116 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms]]	2699	1608.7	
gain [dBi], main beam			
height [m], above site surface		5,7	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms]]	and the second s	2667.	
elevation angle [deg]			
Location, latitude	38°45'50.4"N		
longitude	104°51'50.4"W	103°59'02.4"W	
Path bearing			
elevation [m-ms1]	and the second s	-	
Other information:			

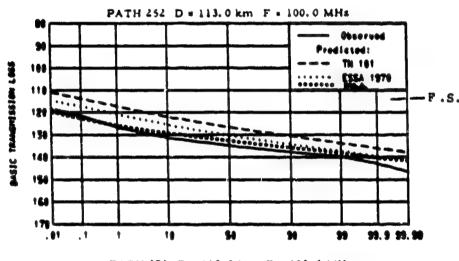
Figure 87. Path 10290, parameters.

Path Number:	1 0 3 1	0	
Code Number: 1 1 3 1 1 0	0 4 5 2 1 1	2 8 1 1	
Location: Cheyenne Mountain Su	mmit, Colorado - I	Kendrick, Colorado	
Data type 7855 hourly medians		6 km,h 1603	m-ms l
N 248 N-units, a 7826	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 1046 MHz, Transmit	ter output	dBW, EIRP	d8W
Ah 116 m. n mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2670.	1616.3	
gain [dBi], main beam			
height [m], above site surface		13.3	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance (km)		79.6	
elevation [m-ms1]		2667	
elevation angle [deg]			
Location, latitude	38045150.4"11	38031'08,4"N	1
longitude	104051 50.4"W	103°59'02,4"W	
Path bearing			
elevation [m-ms]]			
Other information:			

Figure 88. Path 10310, parameters.

CHEYENNE MTN S COLO - KARVAL COLO PATHS 252 266 TO 268,272 292 298 311 TO 313





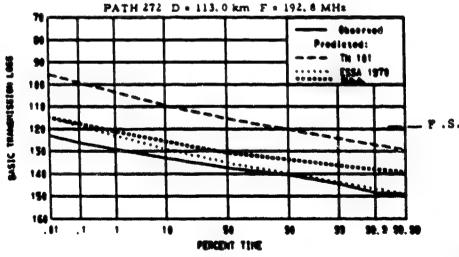


Figure 89. Paths 10252 and 10272, profile and predictions.

Path Number: Code Number: 1 1 2 1 1 0 0 Location: Cheyenne Mountain Sw Data type 11782 hourly medians N. 250 N-units, a 7846	mmit, Colorado - _, Distance <u>113.</u>	2 8 1 1 Karval, Colorado 0 km,h 1542	m-ms 1
Climate continental temperate			km
Frequency 100 MHz, Transmitte	er output	dBW, EIRP	dBW
Ah 187 m, e mr.			
Antenna elevation [m-ms1]	Transmitter 2683.8	1548.1	
gain [dBi], main beam		6.1	
height [m], above site surface			
line loss [dB] polarization	Н	Н	
type			
Horizon distance [km]		53.43	
elization [m-ms]]		1817.	
elevation angle [deg] Location, latitude	38°45'50.4"N	38 ⁰ 37'55.2"N	
longitude	104°51'50.4"W	103°34'19.2"W	
Path bearing elevation [m-ms1] Other information:			

Figure 90. Path 10252, parameters.

Path Number:	1 0 2 7	2	
Code Number: 1 1 2 1 1 0	0 4 5 2 1 1	2 8 1 1	
Location: Cheyenne Mountain Se	ummit, Colorado -	Karval, Colorado	
Data type 6967 hourly medians	, Distance <u>11</u>	3.0 km, h 1542	m-ms l
N. 250 N-units, a 7846	km, Surface ty	pe average around	
Climate continental temperate		de	km
Frequency 192.8 MHz, Transmit			dBW
Δh 187 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2699	1547.8	
gain [dBi], main beam			
height [m], above site surface		6.1	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		53.43	
elevation [m-ms]]		1817.	
elevation angle [deg]			
Location, latitude	38°45'50,4"N	38° 37' 55, 2"N	
longitude	104°51'50.4"W	103 ⁰ 34'19.2"W	
Path bearing			
clevation [m-msl]			
Other information:			

Figure 91. Path 10272, parameters.

CHEYENNE MIN'S COLO . KARVAL COLO

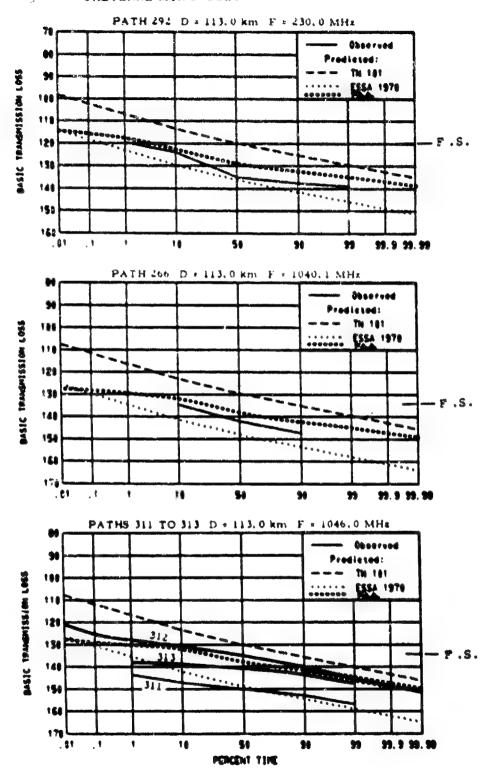


Figure 92. Paths 10292, 10266, and 10311 through 10313, predictions. (see Figure 89 for profile)

114

Code Number: 1 1 2 2 1 0 0 Location: Cheyenne Mountain Su Data type 909 hourly medians	ummit, Colorado - _, Distance11	2 8 1 1 Karval, Colorado 3.0 km, h 1542	n-ms l
N _s <u>250</u> N-units, a <u>7846</u> Climate continental temperate			ium
Frequency 230 MHz, Transmitt			dBW
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2699	1547.8	
gain [dBi], main beam			
height [m], above site surface		5,8	
line loss [dB]		· · · · · · · · · · · · · · · · · · ·	
polarization	Н	Н	
type			
Horizon distance [km]		53,43	
elevation [m-msl]		1817.	
elevation angle [deg]			
Location, latitude	38°45'50.4"N	38° 37' 55.2"N	
longitude	104°51'50.4"W	103° 34' 19, 2"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 93. Path 10292, parameters.

Code Number: 1 1 3 1 1 0 0 Location: Cheyenne Mountain Su Data type 232 hourly medians No 250 N-units, a 7846	mmit, Colorado - M , Distance 113.0 km, Surface typ	2 8 1 1 Carval, Colorado km,h _{rs} 1542 e average ground	m-ms l
Climate continental temperate			km
Frequency 1040.1 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 187 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2670	1544.9	
gain [dBi], main beam			
height [m], above site surface		2.9	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		53,43	
elevation [m-msl]		1817.	
elevation angle [deg]			
Location, latitude	38°45'50.4"N	38 ⁰ 37'55.2"N	
longitude	104°51'50.4"W	103° 34' 19.2"W	
Path bearing		anagas manga - sinado sino - sindilio sino ilia (sinado sino - sindilio sino sinado sino sindilio sino sindilio	
elevation [m-msl]		do an day - results has sirellingay-reloy to announceablifications	
Other information:			

Figure 94. Path 10266, parameters.

Path Number: Code Number: 1 1 3 1 1 0 Location: Cheyenne Mountain S Data type 599 hourly medians	Summit, Colorado -	2 8 1 1 Karval, Colorado	n-ms 1
N. 250 N-units, a 7846	km. Surface tv	De guerane around	
Climate continental temperate		, de	km
Frequency 1044 MHz, Transmi	tter output	dBW, EIRP	dBW
Λh 187 m, θ mr	•		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2670	1543.8	
gain [dBi], main beam			
height [m], above site surface		1.8	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		53,43	
elevation [m-msl]		1817	
elevation angle [deg]			
Location, latitude	38°45'50.4"N	38° 37' 55, 2"N	
longitude	104°51'50.4"W	103°34'19.2"W	
Path bearing			
elevation [m-ms1]			
Other Informations			

Figure 95. Path 10311, parameters.

Path Number:	_1 0 1 1	1	
Code Number: 1 1 3 1 1 0 0			
Location: Cheyenne Mountain Sur Data type 6132 hourly medians			m-ms i
N 250 N-units, a 7846	km, Surface ty	pe average ground	
Climate continental temperate		, de	km
Frequency 1046 MHz, Transmitt	er output	dBW, EIRP	dBW
ih 187 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	2670	1555.4	
qain (dBi), main beam		1	
height [m], above site surface		13.4	
line toss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		53,43	
elevation [m-msl]		1817	
elevation angle [deg]		,	
Location, latitude	38° 45' 50, 4"N	38° 37' 55.2"N	
longitude	104°51'50,4"W	103°34'19.2"W	
Path bearing [mams]	THE RESIDENCE AND THE RESIDENC	t dans straigs par tide og hinn age nægsår mennt ma ge 4 innahlikkelde	
Other information:		s	

Figure 96. Path 10312, parameters.

Path Number:	1 0 3 1	3	
Code Number: 1 1 3 1 1 0	0 4 5 2 1 1	2 8 1 1	
	Summit, Colorado -	•	
Data type 405 hourly median	4 , Distance 113	.0 km.h 1542	m-ms l
N 250 N-units, a 784			
Climate continental temperate			km
Frequency 1046 MHz, Transm			MBE
Δh 187 m, θ m	r.		
	Transmitter	Receiver	
Antenna elevation [m-msl]	2670	1546.6	
gain [dBi], main beam			
height [m], above site surface		4.6	
line loss [dB]			
polarization	Н	Н	
type			
Morizon distance [km]		53.45	
elevation [m-msl]		1817	
elevation angle [deg]			
Location, latitude	38°45'50.4"N	38 ⁰ 37' 55.2"N	
longitude	104°51'50.4"W	103°34'19.2"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 97. Path 10313, parameters.

CHEYENNE MTN S COLO . KARVAL COLO

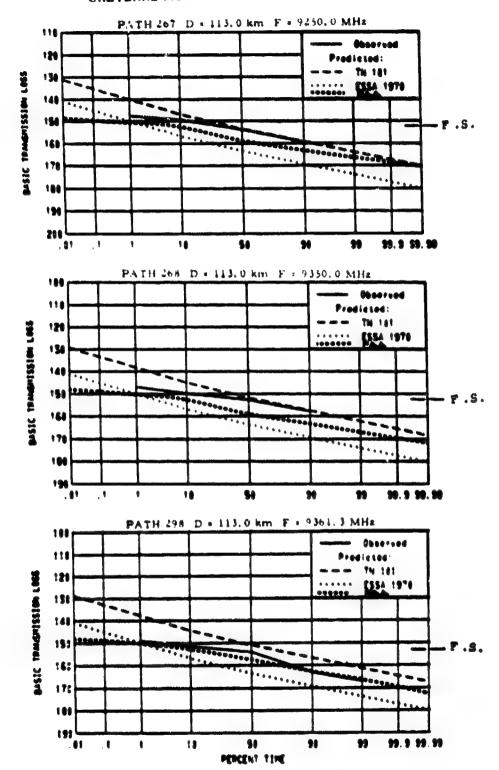


Figure 98. Paths 10267, 10268, and 10298, predictions. (see Figure 89 for profile)

		1 0 2 6		
	1 1 3 9 1 0			
	Cheyenne Mountain S	•		
Data type	183 howrly medians	, Distance113.	.0 km,h 1542	m-ms 1
N 250	N-units, a 7846	km. Surface typ	e average ground	
Climate con	tinental temperate		de	km
	MHz, Transmit			dBW
	m, H mr.			
		Transmitter	Receiver	
Antenna eleva	tion [m+msl]	2670	1544.9	
gain [dBi],	main beam			
height [m].	above site surface		2.9	
line loss [dB}			
polarizatio	n	Н	Н	
type				
<u>Horizon</u> dista	nce [km]		53.43	
elevation [m-ms1]	To the second se	1817.	
elevation a	ngle [deg]			
Location, lat	i tude	32°45'50.4"N	38° 37' 55.2"N	
longitude		104051 50.4"01	103°34'19.2"W	
Path bearing		maganganian derbestelste Greensteit in derbettelste		
elevation [m-m: 1]		migratio em Gargarello qualipallist vo dello relación designos.	
043	• * · · · ·			

Figure 99. Path 10267, parameters.

	Path Number:	1 0 2 6	8	
Code Number: 1	1 3 9 1 0			
	heyenne Mountain S			
Data type1	86 hourly mediuns	, Distance 113	1.0 km.h 1542	m-ms l
N 250	_N-units, a 784	6 km. Surface ty	pe average ground	
Climate conti	nental temperate		, de	km
	MHz, Transmi			dBW
	m, H mr			
		Transmitter	Receiver	
Antenna elevati	on [m-ms1]		1544.9	
gain (dBi), m	ain beam			
	bove site surface		2.9	
line loss [dB	1			
polarization		Н	Н	
type				
<u>Horizon</u> distanc	e [km]		53.45	
elevation [m-	ms1]		1817	
elevation any	le [deg]			
Location, latit	ude	38°45'50.4"N	38 ⁰ 37' 55, 2"N	
longitude		104°51'50.4"W	103°34'19.2"W	
Path bearing				
elevation [m-	ms 1]			
Other informati	4373 *			

Figure 100. Path 10268, parameters.

	Path Number:	1 0 2 9	8	
Code Number:	1 1 3 9 1 0 0	1 4 5 2 1 1	2 8 1 1	
	Karval, Colorado - C	_	The state of the s	
	147 hourly medians			m-ms1
N 250	N-units, a 7846	km, Surface typ	e average ground	
Climate com	stinental temperate		de	km
Frequency q3	MHz, Transmit	ter output	dBW, EIRP	dBW
Ah 187	m, 0 mr.			
		Transmitter	Receiver	
Antenna eleva	tion [m-ms1]	1545	2668.5	
gain [dBi],	main beam			
height [m],	above site surface			
line loss [dB]		•	
polarizatio	n	Н	Н	
type				
Horizon dista	nce [km]	53.43	,	
elevation [m-ms l]	1817		
elevation a	ngle [deg]			
Location, lat	i tude	38 ⁰ 37'55.2"N	38 ⁰ 45'50.4"N	
long i tude		103°34'19.2"W	104°51'50.4"W	
Path bearing				
elevation [m-m 51]			
Other informa	tion:			

Figure 101. Path 10298, parameters.

PATHS 254 274 294 314 CHEYENNE MTN S COLO - HASWELL COLO

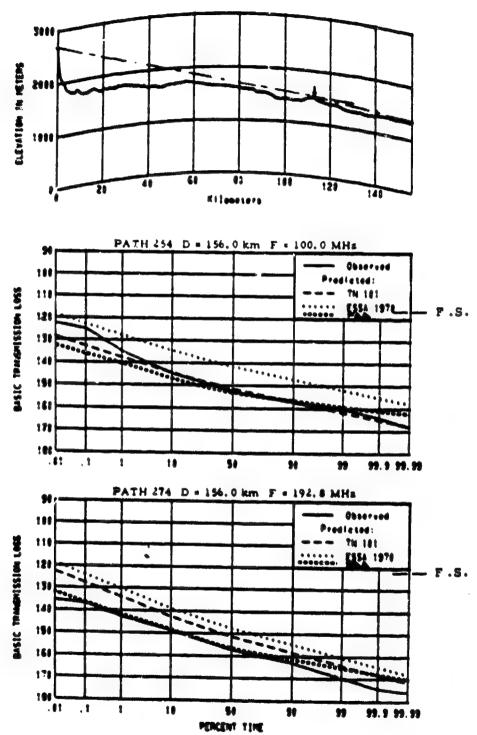


Figure 102. Paths 10254 and 10274, profile and predictions.

	Path Number:	1 0 2 5	4	
Code Number:	1 1 2 1 2 3	0 4 5 2 1 1	2 8 1 1	
Location:	Cheyenne Mountain	Summit, Colorado	- Haswell, Colorado	
Data type	9999 hourly media	16 , Distance 1	56.0 km, h 1334	m-ms 1
N	N-units, a 785	km. Surface ty	ne average ground	
Climate con	tinental temperate		de	km
Frequency 100	MHz, Transmi	tter output	dBW, EIRP	dBW
• •		Transmitter	Receiver	
Antenna elevat	ion [m-ms1]	2683.8	1339.3	
gain [dBi],	main beam			
height [m].	above site surface		5.3	
line loss [d				
polarization		Н	Н	
type				
<u>Horizon</u> distan	ce [km]		43	
elevation (m	-ms1]		1487	
elevation and	gle [deg]			
Location, lati	tude	38°45'50.4"N	38°22'58.8"N	
longitude		104°51'50.4"W	103°08'27.6"W	
Path bearing				
elevation [m-	-ms1}			
Other Informati	t			

Figure 103. Path 10254, parameters.

Path Number:	1 0 2 7	4	
Code Number: 1 1 2 1 2 3	0 4 5 2 1 1	2 8 1 1	
Location: Cheyenne Mountain S	ummit, Colorado -	Haswell, Colorado	
Data type 6205 hourly medians	, Distance15	6.0 km, h 1334	m-nis!
N _s <u>251</u> N-units, a <u>785</u>	6 km, Surface ty	pe <u>average ground</u>	
Climate continental temperate		de	km
Frequency 192.8 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 114 m, 6 mr.			
	•		·
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2699	1339	
gain [dBi], main beam			
height [m], above site surface		5	
line loss [dB]			
polarization	Н	. Н	
type			
Horizon distance [km]		43	
elevation [m-msl]		1487	
elevation angle [deg]			
Location, latitude	38°45'50.4"N	38°22'58.8"N	
longitude	104°51'50.4"W	103°08'27.6"W	
Path bearing			
elevation [m-ms1]	THE BOOK AND	THE RESERVE OF THE PROPERTY OF THE PARTY OF	
Other information		an ann san sign a saight agus a deithigh san a a saigheann ann an	

Figure 104. Path 10274, parameters.

CHEYENNE MTN S COLO - HASWELL COLO

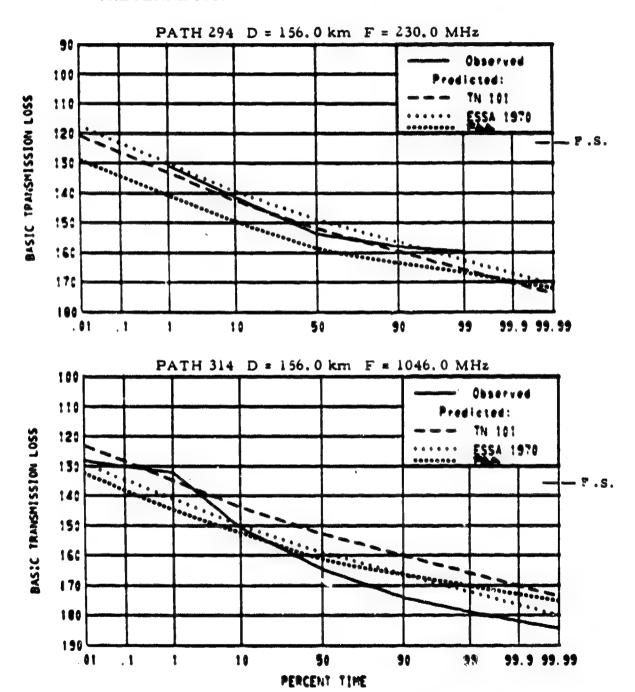


Figure 105. Paths 10294 and 10314, predictions. (see Figure 102 for profile)

	Path Number:	1 0 2 9	4	
Code Number: Location:	1 1 2 2 2 3 Cheyenne Mountain S			
Data type	195 hourly medians	, Distance 15	6.0 km, h 1334	m-ms 1
	N-units, a7856	km, Surface ty	pe_average_ground	
Climate cont	inental temperate		de	km
Frequency 230	MHz, Transmit	ter output	dBW, EIRP	dBW
	m, 0 mr.			
		Transmitter	Receiver	
Antenna elevat	ion [m-ms1]	2699	1339	
gain [dBi], s	main beam			
height [m],	above site surface		5	
line loss [di	B]			
pularization		Н	н	
type				
Horizon distanc	ce [km]		43	
elevation (m	-ms1)		1487	
elevation and	ale [deq]			
Location, lati	tude	38° 45' 50.4"N	38°22'58.8"N	
longitude		104°51'50.4"W	103°08'27.6"W	
Path bearing				
elevation (m	-ms1]	The second section of the section of the second section of the section of the second section of the sect		
Other Internal	•			

Figure 106. Path 10294, parameters.

Path Number:	1 0 3 1	4	
Code Number: 1 1 3 1 2 3 0	4 5 2 1 1	2 8 1 1	
Location: Cheyenne Mountain Su	mmit, Colorado -	Haswell, Colorado	
Data type 7007 hourly medians	, Distance156.	0 km, h 1334	m-ms1
N 251 N-units, a 7856	km, Surface ty	pe average ground	
Climate continental temperate		de	km
Frequency 1046 MHz, Transmit	ter output	dBW. EIRP	dBW
2h 114 m, θ mr.	-		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2670	1346.6	
gain [dBi], main beam			
height [m], above site surface		12.6	
line loss [dB]		Company of the Spanish of the Spanis	
polarization	Н	Н	
type			
Horizon distance [km]		43.0	
elevation [m-ms1]	The state of the s	1487	
elevation angle [deg]			
Location, latitude	38°45'50.4"N	38°22'58.8"N	
long i tude	104°51'50.4"W	103°08°27.6"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 107. Path 10314, parameters.

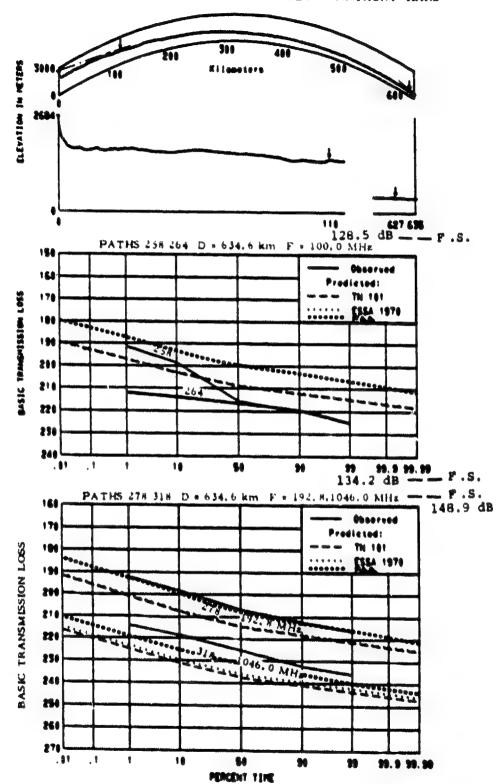


Figure 108. Paths 10258, 10264, 10278, and 10318, profile predictions.

Path Number:	1 0 2 5	8	
Code Number: 1 1 2 1 3 8	0 4 5 2 1 1	2 8 1 1	
Location: Cheyenne Mountain	iummit, Colorado -	Anthony, Kansas	
Data type 537 hourly medians N _S 272 N-units, a 8090	, Distance 63	4.6 km, h 407	m-ms 1
N. 272 N-units, a 8090	km, Surface ty	pe average ground	
Climate continental temperate		de	km
Frequency 100 MHz, Transmit			dBW
Ah 171 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	2683.8	418.8	
gain [dBi], main beam			
height [m], above site surface		11.9	
line loss (dB)			
polarization	Н	Н	
type			
Horizon distance [km]		8	
elevation [m-msl]		432,8	
elevation angle [deg]			
Location, latitude	38°45'50.4"N	37°14'24"N	
longitude	104°51'50.4"W	97°53'52.8"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 109. Path 10258, parameters.

	Path Number: 1 1 2 1 3 6 0	1 0 2 6	4	
Code Number:	1 1 2 1 3 0 0	4 5 2 1 1	2 8 1 1	
Location:	Cheyenne Mountain Su	mmit, Colorado -	Anthony, Kansas	
Data type	266 hourly medians 2 N-units, a 8090	_, Distance 63	4.6 km.h 407	m-ms l
N 27	2 N-units, a 8090	km. Surface ty	pe average ground	
Climate con	ntinental temperate		de	km
	0 MHz, Transmitt			dBW
	m, 11 mr.			
		Transmitter	Receiver	
Antenna eleva	tion [m-ms1]	2683.8	418.8	
gain [dBi],				
	above site surface		11.9	
, ,				
line loss [Н	Н	
polarizatio	n			
type				
Horizon dista			432.8	
elevation (tion parties. All recognition rates are consider a solution for the contraction	43610	
elevation a		38°45'50.4"N	37 ⁰ 14'24"N	
Location, lat	itude		97°53'52.8"W	
longitude		104°51'50.4"W	97°53'52,8"W	
Path bearing		ganga maga, sahun sa nap mbanda da ni nda atawa da bar	and the state of t	
elevation [n-m,1]	ganglar garanga 4, anna an 1 - de titr at 1 de titration de services de la	y	
Other Interna	ition:			

Figure 110. Path 10264, parameters.

Path Number:	1 0 2 7	8	
Code Number: 1 1 2 1 3 0 0 Location: Cheyenne Mountain Sum	mmit, Colorado - A	nthony, Kansas	
Data type 243 hourly medians	_, Distance 634.	6 km, h, 407	m-ms l
N _S 272 N-units, a 8090	km, Surface type	e average ground	 -
Climate continental temperate		de	km
Frequency 192.8 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 171 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2699	418.8	
gain [dBi], main beam			
height [m], above site surface		11.9	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		. 8	
elevation [m-ms1]		432.8	
elevation angle [deq]			
Location, latitude	38°45'50.4"N	37 ⁰ 14'24"N	
longitude	104°51'50.4"W	97°53'52.8"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 111. Path 10278, parameters.

Path Number: Code Number: 1 1 3 1 3 0 Location: Cheyenne Mountain S Data type 184 hourly medians N _S 272 N-units, a 8090	ummit, Colorado - , Distance 634	Anthony, Kansas	m-ms1
Climate continental temperate	surrace ty	de	km
Frequency 1046 MHz, Transmit	ter output	dBW, EIRP	dBW
Antenna elevation [m-msl] gain [dBi], main beam	Transmitter 2670	Receiver 409.6	
height [m], above site surface line loss [dB]		2.7	
polarization type	Н	Н	
Horizon distance [km] elevation [m-msl]		8.0 432.8	
elevation angle [deg] Location, latitude	38°45'50.4"N	37 ⁰ 14'24"N	
longitude Path bearing elevation [m-msl]	104°51'50.4"W	97°53'52,8"W	
Other information:	-	The state of the s	

Figure 112. Path 10318, parameters.

PATH 260 CHEVENNE HTM S COLO - FAVETTEVILLE ARK

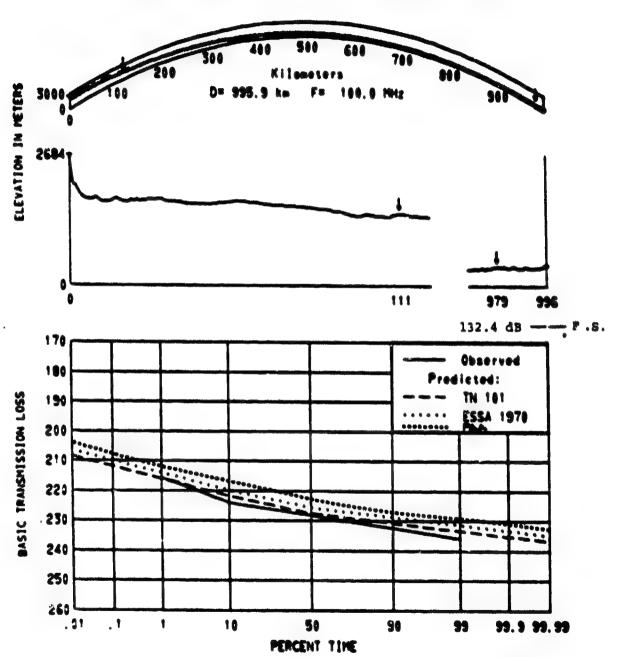
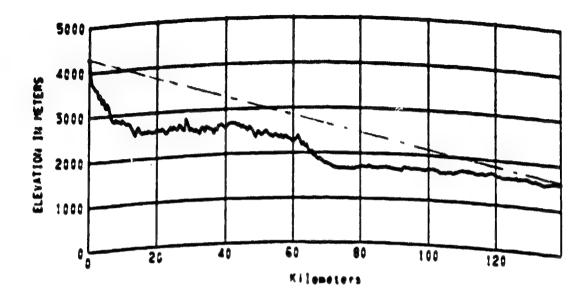


Figure 113. Path 10260, profile and predictions.

Path	n Number:	_1 0 2 6	0	
Code Number: 1 1	2 1 3 0 0	4 5 2 1 1	2 8 1 1	
Location: Chey	enne Mountain Su	mmit, Colorado -	Fayetteville, Arkai	rsas
Data type 120	hourly medians	_, Distance995	.9 km,h 396.2	m-ms l
N 276 N-	units, a 8140	_km, Surface typ	oe average ground	-
Climate continent	al temperate		de	km
Frequency 100				dBW
Δh 384 m, θ	mr.			
		Transmitter	Receiver	
Antenna elevation [r	n-ms1]	2683.8	432.2	
gain [dBi], main t	beam			
height [m], above	,		11.6	
line loss [dB]				
polarization		Н	Н	
type				
Horizon distance 1km	m)		16.6	
elevation [m-ms]]			396.2	
elevation angle (deg]			
Location, latitude		38°45'50.4"N	36 ⁰ 06'25.2"N	
longitude		104°51'50.4"W	94°06'25.2"W	
Path bearing				
elevation [m-ms1]				
Other information:				

Figure 114. Path 10260, parameters.



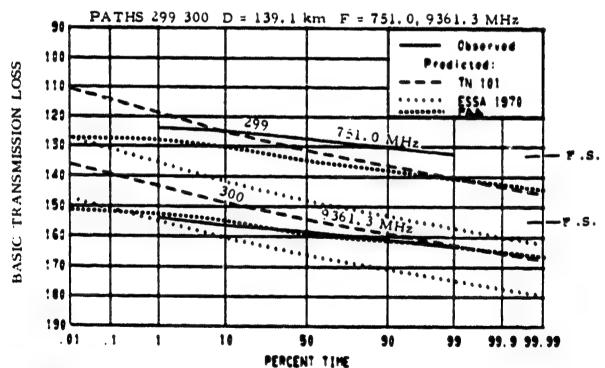


Figure 115. Paths 10299 and 10300, profile and predictions.

Path Number:	1 0 2 9	9	
Code Number: 1 1 2 7 1 0 0			
Location: Pikes Peak, Colorad	lo - Gunbarrel Hil	L, Colorado	
Data type 192 hourly medians	, Distance139).1 km.h 1583	m=ms1
N _s <u>249</u> N-units, a <u>7836</u>	km, Surface ty	pe average ground	
Climate continental temperate		de	km
Frequency 751 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 518 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	4302.5	1585.7	
gain [dBi], main beam			
height [m], above site surface		2. 7	
line loss [dB]	**************************************		
polarization	Н	Н	
type			
Horizon distance [km]		10.06	
elevation [m-ms1]		1633	
elevation angle (deg)	(The second of		
Location, latitude	38°50'26.2"N	40°05'31"N	
longitude	105°02'38.5"W	105°07'17.5"W	
Path bearing			
elevation [m+ms1]		dadis reser bengampedagga aggeria again - 10 disa dala	
Other information:	eller die belieben der	artii - ib dheadrann a sib sipangagairt a gan milangaga ga a	

OT/TRER 16, fig. 1.14

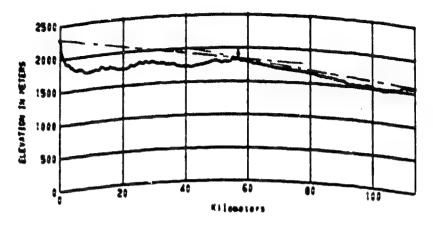
Figure 116. Path 10299, parameters.

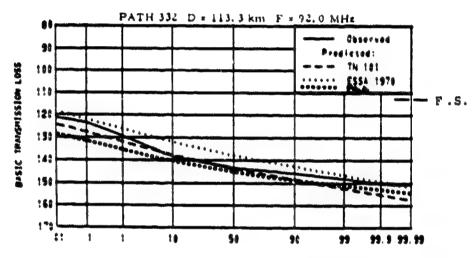
Path Number: Code Number: 1 1 3 9 1 0 0 Location: Pikes Peak, Colorado	4 5 2 1 1	2 7 1 1	
Data type 315 hourly medians			m-ins l
N 249 N-units 2 7836	km Surface tv	e average ground	
N _s 249 N-units, a 7836 Climate continental temperate	-	de	km
Frequency 9361.3 MHz, Transmit			dBW
Δh 518 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	4302.5	1585.7	
gain [dBi], main beam			
height [m], above site surface		2.7	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		10.06	
elevation [m-insl]		1633	
elevation angle [deg]			
Location, latitude	38°50'26.2"N	40°05'31"N	
longitude	105°02'38.5"W	105°07'17.5"W	
Path bearing			
elevation [m-ms1]			
Other information:			

OT/TRER 16, 64g. 1.14

Figure 117. Path 10300, parameters.

PATHS 332 352 372 CHEYENNE MTN B COLO - KARVAL COLO





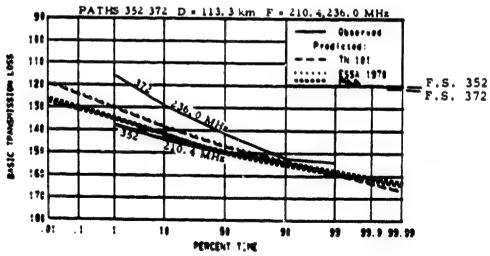


Figure 118. Paths 10332, 10352, and 10372, profile and predictions.

Path Number: Code Number: 1 1 2 0 2 3 Location: Cheyenne Mountain B		2 8 1 1	
Data type 6594 hourly medians	, Distance 11	3.3 km, h 1561	m-ins l
N _s 241 N-units, a 1758 Climate continental temperate	km, Surface ty	pe average ground	km
Frequency 92 MHz, Transmit		•	dBW
Δh 163 m, θ mr.			
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface	Transmitter 2281.4	1571.9	
line loss [dB] polarization type	Н	Н	
Horizon distance [km]		56.5	
elevation [m-msl]		1829	
elevation angle [deg]			
Location, latitude	38°46'26.4"N	38°37'55.2"N	
long i tude	104°51'43.2"W	103°34'19.2"W	
Path bearing elevation [m-ms1] Other information:			

Figure 119. Path 10332, parameters.

Path Number:	1 0 3 5	2	
Code Number: 1 1 2 2 2 3 0	4 5 2 1 1	2 8 1 1	
Location: Cheyenne Mountain Ba	se, Colorado - Ka	urval, Colorado	
Data type 1244 hourly medians	_, Distance	3.3 km.h 1561	m-ms1
N _s 241 N-units, a 7758	km, Surface ty	po <u>average ground</u>	
Climate continental temperate		, de	km
Frequency 210.4 MHz, Transmitt	er output	dBW, EIRP	dBW
∆h <u>163</u> m, +- mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2287.5	1571.6	
gain [dBi], main beam			
height [m], above site surface		10.6	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		56.5	
elevation [m-msi]		1829	
elevation angle [deg]			
Location, latitude	38°46'26.4"N	38°37'55.2"N	
longitude	104°51'43.2"W	103°34'19.2"W	
Path bearing			
elevation [m-ms1]			
Other information:		de 🕮 1990 (1) - 1900 (1) (1) ogla engla engla engla eldere elde skielenden blikkelde eng	

Figure 120. Path 10352, parameters.

Path Number:	1 0 3 7	2	
Code Number: 1 1 2 2 2 3	0 4 5 2 1 1	2 8 1 1	
Lipoation: Cheyenne Mountain E			
Data type 483 hourly medians	, Distance11:	3.3 _{km,h} 1561	m-ms1
N <u>241 N-units</u> 3 7758	km. Surface tv	pe average around	
Climate continental temperate		de	km
Frequency 236 MHz, Transmi	tter output	dBW. EIRP	dBW
Δh 163 m, θ mr	•		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2287.5	1571.6	
gain [dBi], main beam			
height [m], above site surface		10.6	
line loss [dB]			
polarization	K	Н	
type			
Horizon distance (km)		56.5	
elevation [m-ms]]		1829	
elevation angle [deg]		1067	
Location, latitude	38°46'26.4"N	38° 37' 55. 2"N	
longitude	104°51'43.2"W	103°34'19.2"W	
Path bearing			
elevation (m-msl)	Antibodis anti-communication date date in the contraction date.	- A C - Consider the contract of the contract	
Other information:		Statiller de ville de en 19 de décidir de en 1900 de 1900 est uniformation	

OT/TRER 16, 8ig. 2.32

Figure 121. Path 10372, parameters.

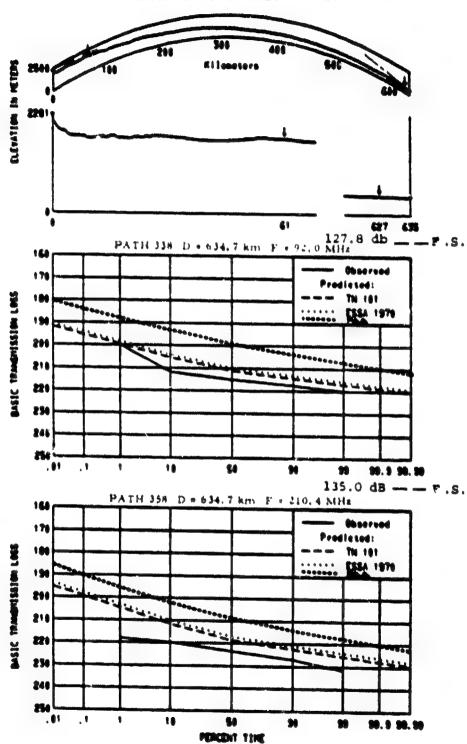


Figure 122. Paths 10338 and 10358, profile and predictions.

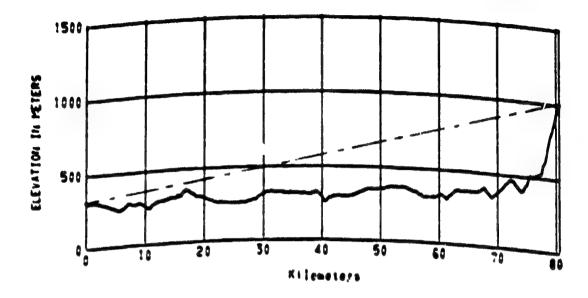
	Path Number:	1 0 3 3	8	
Code Number:	1 1 2 0 3 0	0 4 5 2 1 1	2 8 1 1	
Location:	Cheyenne Mountain B	ase, Colorado - A	nthony, Kansas	
Data type	134 hourly medians	, Distance63	4.7 km.h 407	m-ms1
N	N-units, a 8042	km, Surface typ	oe average ground	
Climate cor	stinental temperate		de	km
Frequency 92	MHz, Transmit	ter output	dBW, EIRP	dBW
	m, 6 mr.			
		Transmitter	Receiver	
Antenna elevat	ion [m-ms1]	2281.4	418.8	
gain [dBi],	•			
	above site surface		11.9	
line loss (d	18]			
polarization	1	Н	Н	
type				
Horizon distan	ice (km)		8.1	
elevation [m	1-ms1}		432.8	
elevation an	agle [deg]			
Location, lati	tude	38°46'26.4"N	37 ⁰ 14'24"N	
longitude		104°51'43.2"W	97°53'52.8"W	
Path bearing				
elevation (m	· m , 1]			
Attor informat	1			

Figure 123. Path 10338, parameters.

Path Number: Code Number: 1 1 2 2 3 0 Cheyenne Mountain Bountain	0 4 5 2 1 1 ase, Colorado - An Distance63	2 8 1 1 thuny, Kansas 4.7 km,h 407	m-ms l
N, 268 N-units, a 804: Climate continental temperate	Zkm, Surface ty	e average ground	
Frequency 210.4 MHz, Transmit 5h 171 m, 0 mr.	ter output	dBW, EIRP	km dBW
	Transmitter	Receiver	
Antenna elevation [m-ms1]	2287.5	418.8	
gain [dBi], main beam			
height [m], above site surface		11.9	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		8.1	
elevation [m-ms1]		432.8	
elevation angle [deg]			
Location, latitude	38°46'26.4"N	37°14'24"N	
longitude	104°51'43.2"W	97°53'52.8"W	
Path bearing			
elevation [m-ms1]		eritään tuure er olla viilla v	
Other information:		Mary and description of the plants of the state of the st	

Figure 124. Path 10358, parameters.

PATHS 447 TO 449 GEORGIA TECH GA - MT OGLETHORPE GA



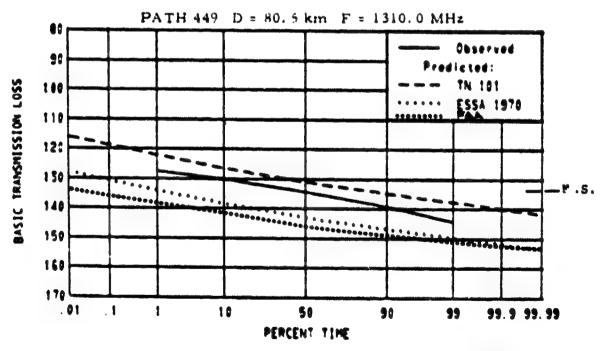


Figure 125. Path 10449, profile and predictions.

Path Number:	1 0 4 4	9	
Code Number: 1 1 3 1 1 0 0	4 5 2 1 1	2 2 1 1	
Location: Georgia Technology,			
Data type 1500 hour'y medians	, Distance80.	.5 km,h 298	m-ms 1
N _s 296 N-units, a 8416	km, Surface typ	e average ground	
climate continental temperate		de	km
Frequency 1310 MHz, Transmitt			dBW
Ah 125 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	317	1005.9	
gain [dBi], main beam			
height [m], above site surface	18.3		
line loss [dB]			
polarization	Н	Н	
type			
Morizon distance [km]		80.5	
elevation [m-msl]		1001.9	
elevation angle [deq]			
Location, latitude			
longitude			
Pati bearing			
elovation [mems1]		die olika diek 6. aktoromizoskowiniajelosk	
Other information:			

Figure 126. Path 10449, parameters.

GEORGIA TECH GA - MT OGLETHORPE GA

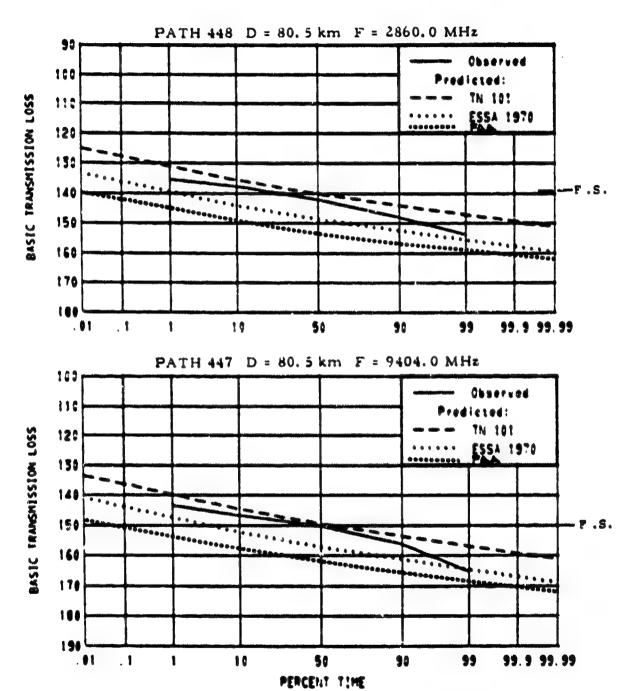


Figure 127. Paths 10448 and 10447, predictions. (see Figure 125 for profile)

Path Number:	1 0 : 4	8	
Code Number: 1 1 3 2 1 0 0	$\frac{1}{1} \frac{0}{4} \frac{1}{5} \frac{0}{2} \frac{1}{1} \frac{1}{1}$	2 2 1 1	•
Location: Georgia Technology,	Georgia - Mt. Ogl	ethorpe, Georgia	
Data type 1 year of hourly median	å, Distance 80.	5 km, h 298	m-ms1
N _s <u>296</u> N-units, a <u>8416</u>	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 2860 MHz, Transmit	ter output	dBW, EIRP	dBW
5h 125 m, 9 mr.			
	Transmitter	Receiver	
Antonna elevation [m-ms1]	317	1005.9	
gain (dBi), main beam		,	
height [m], above site surface	18.3		
line loss [dB]			
polarization	Н	Н	
type		,	
Horizon distance [km]		80.5	
elevation [m-ms1]		1001.9	
elevation angle [deg]			
Location, latitude	Andreader creation and the risk interfere destinations. As the upon the		
longitude	Minimum market annual subject to the contract of the contract		
Path bearing			
elevation [m-ms1]	anner und verricht. Alle der ich erhalbe der ich erde mes ich soppier	tive than the Madlin trade transportational Massach trade	
Other information:		49 (89) 150 (89) distillibritation on our car a gradual dispublicana	

Figure 128. Path 10448, parameters.

Pat	th Number:	1 0 4 4	1	
Code Number: 1 1	3 9 1 0 0	4 5 2 1 1	2 2 1 1	
Location: George	gia Technology,	Georgia - Mt. Ogli	thorpe, Georgia	
Data type 2000	hourly medians	_, Distance80).5 km,h 298	m-ms l
N 296 N	-units, a 8416	km, Surface typ	e average ground	
Climate continen	tal temperate		de	km
Frequency 9404	MHz, Transmitt	ter output	dBW, EIRP	dBW
5h 125 m, 6				
		Transmitter	Receiver	
Antenna elevation	[m-ms1]	317	1005.9	
gain [dBi], main	beam			
height [m], above	e site surface	18,3		
line loss [dB]				
polarization		<u>H</u>	Н	
type				
Horizon distance [km}		80.5	
elevation [m-ms]	1		1001.9	
elevation angle	[deg]			
Location, latitude				
longitude				
Path bearing				
elevation [m-msl]]			
Other information:				

Figure 129. Path 10447, parameters.

PATHS 457 TO 462 CEDAR RAPIDS IOWA - QUINCY ILL

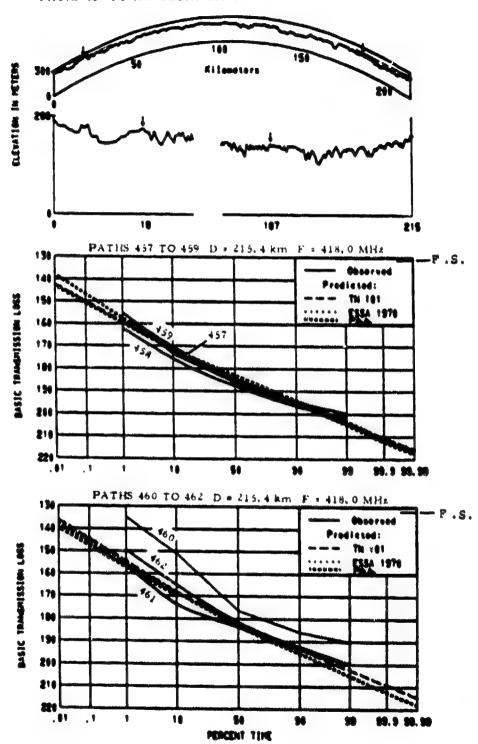


Figure 130. Paths 10457 through 10462, profile and predictions.

		1 0 4 5		
Code Number:	1 1 2 4 3 0 0	4 5 2 1 1	2 8 1 1	
	Cedar Rapids, Iowa -			
Data type	3100 hourly medians	_, Distance <u>215</u>	.4 km, h 207.9	m-ms l
N 303	N-units, a 8525	km, Surface typ	pe average ground	
	inental temperate		de	km
Frequency 418	MHz, Transmitt	er output	dBW, EIRP	dBW
Ah 41	m, θ mr.			
		Transmitter	Receiver	
Antenna elevat	ion [m-ms1]	287.7	234.7	
gain [dBi].				
height [m].	above site surface		9.1	
line loss (d	(B)			
polarization	.	Н	Н	
type				
Horizon distan	ice [km]		28.0	
elevation [n	1=m51]		207.9	
elevation ar	ngle [deg]			
Location, lati	tude	41°53'26"N	39°58'22"N	
longitude		91 ⁰ 42'40 W	91 ⁰ 19154 mW	
Path bearing				
elevation [n	n-ms1]			
Other informat	tion:			

Figure 131. Path 10457, parameters.

Path Number: Code Number: 1 1 2 4 3 Location: Cedar Rapids, Town Data type 1164 hourly median N _S 303 N-units, a 85	a - Quincy, Illinois ns , Distance 215 25 km, Surface ty	.4 km.h 221. De average ground	6 m-ms 1
Climate continental temperate			km
Frequency 418 MHz, Transm	mitter output	dBW, EIRP	dBW
3h 41 m, n	nr.		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	287.7	275.9	
gain [dBi], main beam			•
height [m], above site surface		50.3	•
line loss [dB]	De a commencente que describe delles deputies quelles que de calendario	all Carlotte of the sale of	
polarization	Н	Н	
type			
Horizon distance [km]		42	
elevation [m-ms]]		221.6	
elevation angle [deg]			
Location, latitude	41°53'26"N	39°58'22"N	
longitude	91°42'40"W	91°19'54"W	
Path bearing	- 114 that the same of the sam		
elevation [m-ms1]	errich sarragement, distance with size in specific ellectrichesischen	1996 - HELDERSTEINSTEINSTEINSTEINSTEINSTEINSTEINSTEIN	
Other information:	and note recomming the second property to distinguish a	name. On the his him the distribution of the property of the contract of the c	

Figure 132. Path 10458, parameters.

Path Number:	1 0 4 5		
Code Number: 1 1 2 4 3 0 0	4 5 2 1 1	2 8 1 1	
location: Cedar Rapids, Towa -	Quincy, Illinois		
Data type 1864 hourly medians	, Distance21	5.4 km, h 221.6	m-ms l
N 303 N-units, a 8525	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 418 MHz, Transmit	ter output	dBW, EIRP	dBW
Ah 41 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation (m-ms1)	287.7	336.9	
gain [dBi], main beam			
height [m], above site surface	11.9	4.46 point organization of the first section of the	
line loss [dB]			
polarization	Н	Н	
type	4.4. 4		
Horizon distance [km]	17.7		
elevation [m-msl]	252.4		
elevation angle (deq)		Contact	
Location, latitude	41°53'26"N	39 ° 58 ' 22"N	
longitude	91°42'40"W	91019.54"	
Path bearing .		armine amoreus sign of the category sign of the category sign of the category	
elevation [m-msl]		g ga man disudimensas who signs in to the a ga passing distribution	
Other information:			

Figure 133. Path 10459, parameters.

	Path Number:	i 0 4 6	0	
Code Number:	1 1 2 4 3 0 0	4 5 2 1 1	2 8 1 1	
Location:	Cedar Rapids, lowa -	Quincy, Illinois		
Data type	191 hourly medians	, Distance 215	.4 km, h 221.6	m-ms1
N 303	N-units, a 8525	km, Surface typ	oe average ground	
	inental temperate			km
	MHz, Transmitt			dBW
'n 41	mer.			
		Transmitter	Receiver	
Antenna eleva	tion Im-msll	287.7	367.3	
April 4-differ all regime for to dispute of restriction	-			
gain (dBi), main beam height [m], above site surface		11.9		
		de relation en de la relative que en que en que de la relative de	etakenda esandari saandandikangaanina sharka mendikangaale sa	
line loss [M.	
polarizatio	n	Н	H	
type				
<u>Morizon</u> dista	nce [km]	17.7		
elevation (m = m (T)	252.4		
elevation a	ngle [deg]			
socation, lat	i tude	41 ⁰ 53'26"N	39 ⁰ 58 22"N	
Longitude	•	91°42'40"W	91019'54"4	
Path bearing				
rlevation (inms 1)	empring and to the appropriate the state of	annenn per V 1 50 digit dilikki (10 mig ulphilidar dilikki 14 uliliki dilik	
Other informa	tion:	and a reservation of the second of the second	ers i mei de de «Sarre uns) i terre minimitation de	

Figure 134. Path 10460, parameters.

Path Number:	1 0 4 6	1	
	4 5 2 1 1		
Location: Cedar Rapids, Iowa -	Quincy, Illinois		
Data type 1057 hourly medians	_, Distance21!	i.4 km,h 252.4	m-ms1
N _s 303 N-units, a 8525			
Climate continental temperate	de	km	
Frequency 418 MHz, Transmitt		dBW	
$\Delta h = 41 m, \theta = mr$			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	287.7	397.8	
gain [dBi], main beam			
height [m], above site surface	11.9		
ling loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]	17,7		
elevation [m-msl]	252.4		
elevation angle [deg]			
Location, latitude	41°53'26"N	39°58'22"N	
longitude	91°42°40"W	91°19'54"W	
Path bearing			
elevation [m=ms1]		· · · · · · · · · · · · · · · · · · ·	
Other information:			

Figure 135. Path 10461, parameters.

Path Number: Code Number: 1 1 2 4 3 0 (Location: Cedar Rapids, Iowa	1 0 4 6 0 4 5 2 1 1 - Quincy, Illinoi		
Data type 2322 hourly medians	, Distance 215	.4 km,h 252.4	ni-ms l
N ₂ 303 N-units, a 8525	km, Surface ty	pe average ground	
Climate continental temperate		de	km
Frequency 418 MHz, Transmit	ter output	dBW, EIRP	dBW
th 41 m, n mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	287.7	428.3	
gain [dBi], main beam			
height [m], above site surface	11.9		
line loss [dB]		et en lance i managar-specialisti aparaga interpretario i managama iguanga igu (apaga). Mil filis	
polarization	Н	Н	
type			
Horizon distance [km]	17.7		
elevation [m-ms1]	252.4		',
elevation angle (deg)	and the state of t		
Encation, (atitude	41°53'26"N	39°58'22"N	
longitude	91°42'40"W	91 ⁰ 19'54"W	
Path hearing		· etalitetija aturija ila raja ista simulasi si ja akina aturija aturija aturija a	
elevation (mems1)	The second secon	the second section of the second section of the second sections and the second section	
Other intermation	entillicati, e etti attitutti arita attipiti pattivi attipiti etti attipiti etti attipiti etti attipiti etti a	is necessarily and service topic of a service service service for	

Figure 136. Path 10462, parameters.

PATHS 903 904 ROUND HILL MASS - CRAWFORDS HILL NJ .

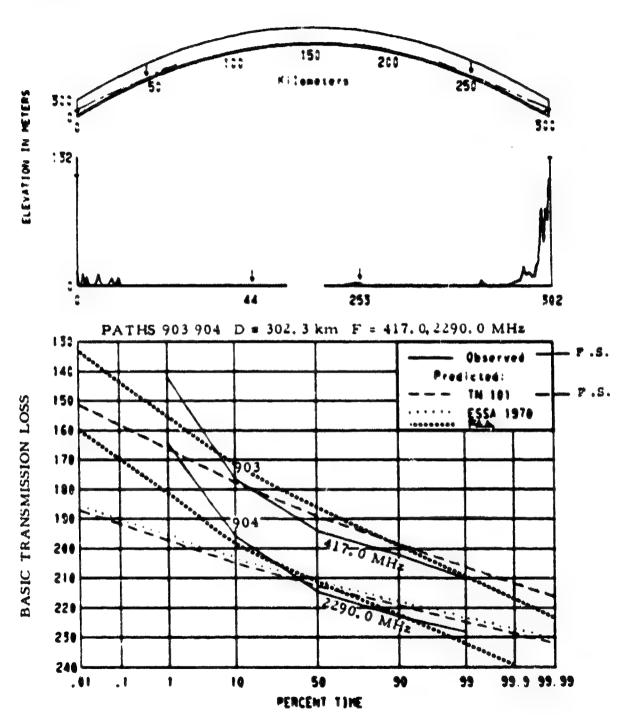


Figure 137. Paths 10903 and 10904, profile and predictions.

	Path Number:		0 9 0	3	
Code Number:	1 1 2 4 3	0 0 4 5	3 1 1	2 1 1 1	
Location:	Round Hill, Mass	achusetts -	Crawford's	Hill, New Jersey	
Data type	240 hourly media	ns, Dista	nce 302.	3 km, h 0	m-ms l
N 312	N-units, a	8676 km Su	rface type	e sea water	
Climate mar	itime temperate o	versea		de	kin
	7 MHz, Trans				dBW
	n. "				
		Trans	mitter	Receiver	
Antenna eleva	tion [mems1]		13.4	132.3	
gain [dBi].	•		delicitation district a decomposition		
, ,	above site surfac	e e	98.9		
line loss [dB]	ear Apontición Europia - registrosso descente	P		
polarizatio	n		Н	Н	
type					
Horizon dista	nce (km)				
elevation [ni-ms []				
elevation a	ngle [deg]				
Location, lat	i tude	41"32"	24"N	40°23'31"N	
longitude		100551	51"W	74°11'13"W	
Path bearing		andreas en euro po especialização	Or Charles warms man		
elevation (m-m-5 1]	OFFICIAL Management of the second			
0.11					

Figure 138. Path 10903, parameters.

Path Nu	mber:	1 0 9 0	4	
Code Number: 1 1 3	2 3 0 0	4 5 3 1 1	2 1 1 1	
			's Hill, New Jersey	
Data type 240 hourl	ly medians	_, Distance30	12.3 km, h 0	m-ms 1
N 312 N-unit	s, a 86.76	km, Surface ty	pe sea water	
Climate maritime tempe	rate oversea		, de	km
Frequency 2290 MH				dBW
Δh 0 m, θ	mr.			
		Transmitter	Receiver	
Antenna elevation [m-ms	1]	113.4	132.3	
gain [dBi], main beam	ı			
height [m], above sit	e surface	98.9		
line loss [d8]				
polarization		Н	Н	
type				
Horizon distance [km]				
elevation [m-ms1]				
elevation angle [deg]				
Location, latitude		41° 32' 24"N	40°23'31"N	
longitude		70°55'51"W	74°11'13"W	
Path bearing				
elevation [m-msl]				
Oak a lafamaalaa				

Figure 139. Path 10904, parameters.



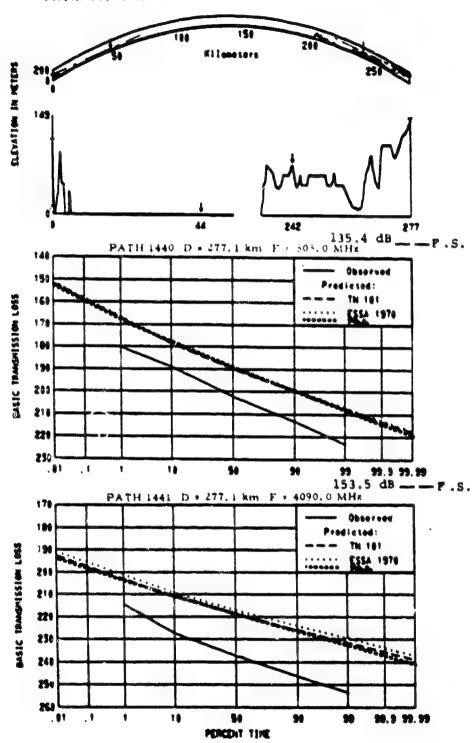


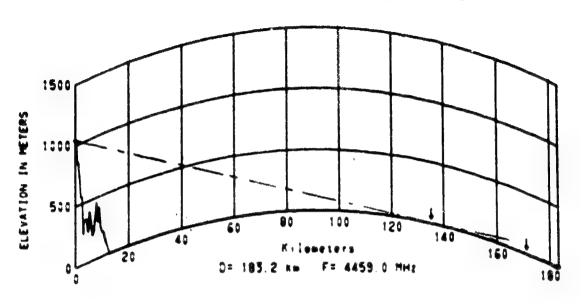
Figure 140. Paths 11440 and 11441, profile and predictions.

Path Number:	1 1 4 4	<u>o</u>	
Code Number: 1 1 2 5 3 0 0	4 5 2 1 1	6 1 1 1	
Location: St. Anthony, Newfound	lland - Gander, New	vfoundland	
Data type 6241 hourly medians	, Distance27	7.1 km,h 0	m-ms 1
N 312 N-units, a 8676	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 505 MHz, Transmit			d BW
Δh 50.2 m, n mr.	•		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	113.4	148.5	
gain [dBi], main beam			
height [m], above site surface		5.2	•
line loss [dB]			
polarization	V	V	
type			
Horizon distance [km]		35.52	
elevation [m-ms1]		75.9	
elevation angle [deg]			
Location, latitude	51°20'55"N	48°57'01"N	
longitude	55° 37' 15"W	54°34'50"W	
Path bearing		anggan ang ang ang ang ang ang ang ang a	
elevation [m-ms1]		an. va. vap- von ordanessen sakin nääskalaisiasia vääse võid na kai -1850 lõjuldansi	
Other information			

Figure 141. Path 11440, parameters.

	Path Number:	1 1 4 4	1	
Code Number:	1 1 3 4 3 0	0 4 5 2 1 1	6 1 1 1	
Location:	St. Anthony, Newfou	ndland - Gander, N	ewfoundland	
Data type	5954 hourly medians	, Distance 27	7.1 km.h 0	m-ms1
N 312	N-units, a8676	km, Surface typ	e average ground	
	nental temperate			km
	4090 MHz, Transmit			dBW
'h 50.2	m, n mr.			
		Transmitter	Receiver	
Antenna elevat	tion [m=ms1]	113.4	148,5	
gain [dBi],	main beam			
	above site surface		5,2	
line loss (d				
polarization	1	Н	Н	
type				
Horizon distar	ice (km)		35.52	
elevation [n-ms1]		75.9	
elevation ar	ngle (deg)			
Location, lati	i tude	51°20'55"N	48°57'01"N	
longitude		55° 37' 15"W	54° 34 ' 50"W	
Path bearing				
elevation [
Other internal	Liests:			

Figure 142. Path 11441, parameters.



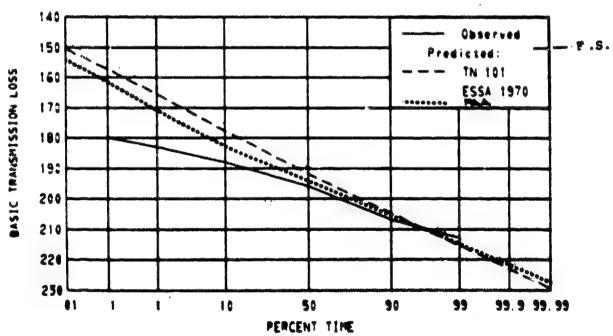


Figure 143. Path 11537, profile; and predictions.

Path Number:			
Code Number: 1 1 3 4 3 0 0		3 3 1 1	
Location: Savana, Italy - Colt			
Data type 269 hourly medians	_, Distance18:	3.2 km,h	m=ms 1
N 320 N-units, a 8822	km, Surface typ	e sea water	
Climate maritime temperate overse	ea .	de	km
Frequency 4459 MHz, Transmitt			dBW
.h 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m=ms1]	1036	8.0	•
gain (dBi), main beam			-
height [m], above site surface		7.0	-
line loss [dB]			-
polarization	Н	Н	•
type			<u>.</u>
Horizon distance [km]			-
elevation [m-ms1]			-
elevation angle [deg]			-
Location, latitude	44°14'57.6"N	43° 39' 33"N	
longitude	8º16'47.9"E	10°24'52"E	_
Path bearing		a specific and the specific of	*
elevation [m:ms1]		many is translation in the Contribution of the contribution of	
All of the Common Long			

Figure 144. Path 11537, parameters.

PATH 1594 PARNIS GREECE - CHIOS ISLAND GREECE

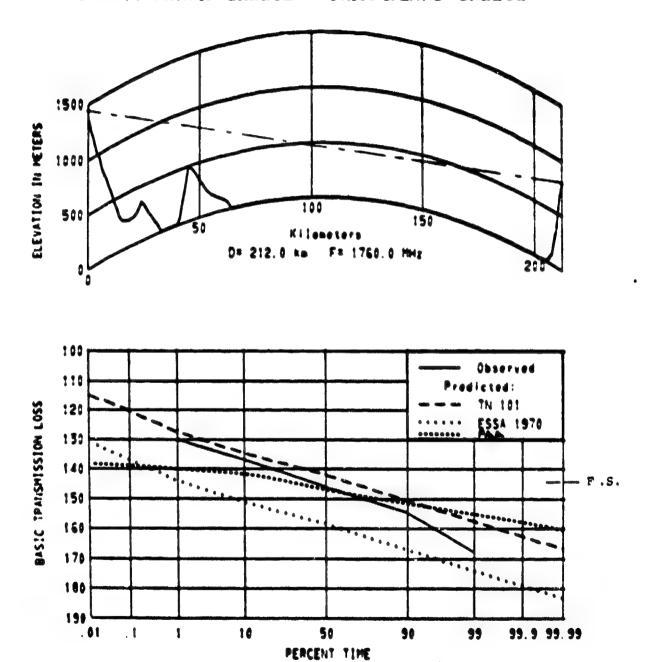


Figure 145. Path 11594, profile and predictions.

Path Number:	1 1 5 9	4	
Code Number: 1 1 3 1 1 0 0	4 5 3 1 1	3 3 1 1	
Location: Parnis, Greece - Chi	os Island, Aegean	Sea	
Data type 100 days of hourly median	<u> 5. Distance</u> 21:	2.0 km, h 0	m~ms1
N. 294 N-units, a 8386		, ,	
Climate maritime temperate overs	ea	de	km
Frequency 1760 MHz, Transmitt			
'h 0 m. i mr.			······································
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1450	800	
gain [dBi], main beam			
height [m], above site surface		4	
line loss [dB]			
polarization	Н	н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude			
longitude			
Path bearing			
elevation [m-msl]			
Other information:			

Figure 146. Path 11594, parameters.



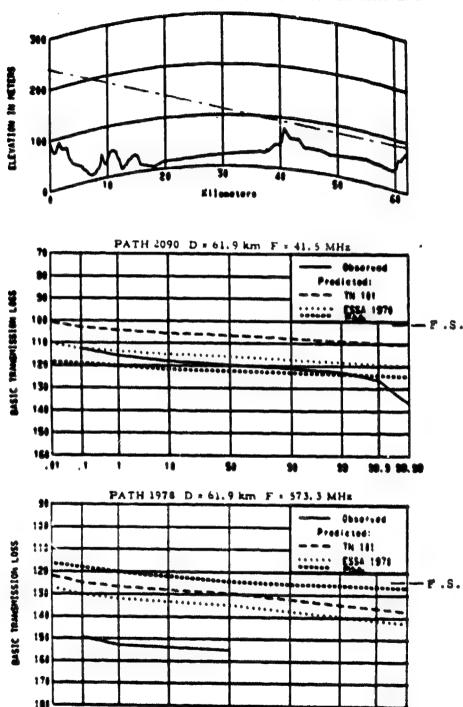


Figure 147. Paths 12090 and 11978, profile and predictions.

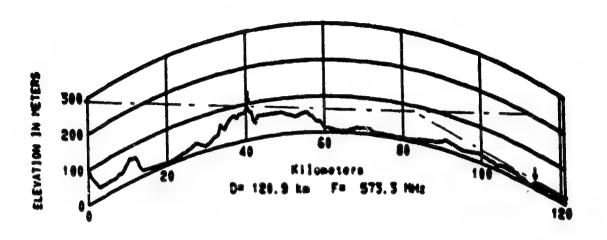
SO PERCENT TIME

Path Number: Code Number: 1 1 2 0 1 0 0 Crystal Palace, Engl Cata type 2588 hourly medians No 315 N-units, a 8729	and - Caversham, , Distance 61 km, Surface type	3 1 1 1 England .9 km, h 40 be average ground	m-ms.l km
Climate maritime temperate overl Frequency 41.5 MHz. Transmitt	ana	dBW. EIRP	JBW
Frequency $\frac{47.5}{m}$, $\frac{MHZ}{m}$, Transmitt	er output		
	Transmitter	Receiver	
Antenna elevation [m-msl]	240.2	91.4	
gain [dBi], main beam			
height [m], above site surface		13.7	
line loss [dB]			
polarization	Н	Н	
type		21.	
Horizon distance [km]		76.	
elevation [m-ms1]			
elevation angle [deg]	51°25'20"N	51°28'52"N	
Location, latitude longitude	0°04'17"W	0°57'23"W	
Path bearing elevation [m-ms1]	remaininke reminisk vijetaren de rekriske i briskeren statumin d		
elevation (m-ms)	The state of the s	Serve a de des des des des de	

Figure 148. Path 12090, parameters.

Path Number: Code Number: 1 1 2 5 1 0 0 Crystal Palace, Englished type hourly medians N. 315 N-units, a 8729	_, Distance6	England 1.9 km,hrs 46	m-ms 1
Climate maritime temperate overli			km
Frequency 573.2 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 53 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	290	88.7	
gain [dBi], main beam			
height [m], above site surface		11	
line loss [dB]			
polarization	н	Н	
type			
Horizon distance [km]		21.	ı
elevation [m-msi]		76.	
elevation angle [deg]			,
Location, latitude	510 25' 20"N	51028'52"N	•
longitude	0°04'17"N	0°57'23"W	
Path bearing			•
elevation [m-ms1]			
Oaku, information:			

Figure 149. Path 11978, parameters.



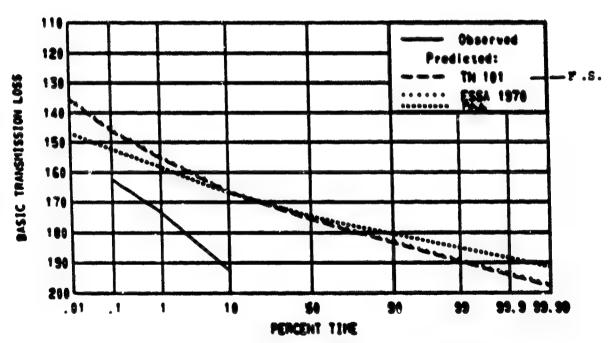
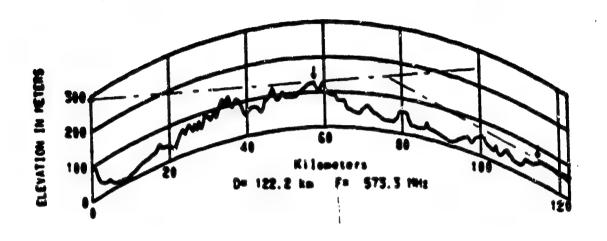


Figure 150. Path 11981, profile and predictions.

Path Number:	1 1 9 8	1	
Location: Crystal Palace, Engli	4 <u>5 2 1 1</u> and - Bawdsey, En	gland	
Data type hourly medians	, Distance 12	0.9 km, h 5	m-ms 1
N _s 319 N-units, a 880			
Climate maritime temperate overla	and .		km
Frequency 573.2 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 55.4 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	290	18	
gain [dBi], main beam			
height [m], above site surface		13	
line loss [dB]			
polarization	н	Н	
type			
Horizon distance [km]		7.4	
elevation [m-msl]		15.	
elevation angle (deg)			
Location, latitude	51°25'20"N	51°59'45"N	
longitude	0°04'17"W	1°25'00"E	
Path bearing			
elevation [m-ms1]			
Other Informations			

Figure 151. Path 11981, parameters.

PATH 1982 CRISTAL PALACE ENG - PETERBOROUGH ENG



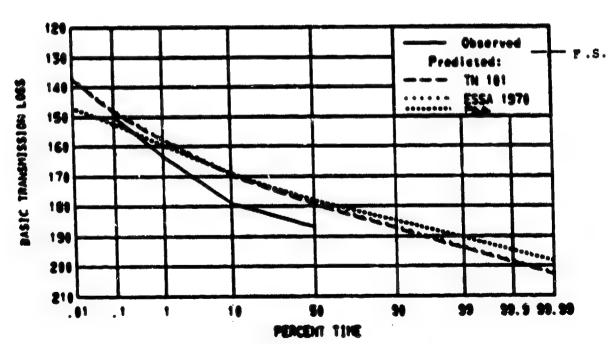


Figure 152. Path 11982, profile and predictions.

Code Number: 1 1 2 5 3 0 0 Location: Crystal Palace, Engla	na - rexerborougi	3 1 1 1 1, England	m-ms 1
Data type hourly medians	_, Distance	average around	m-ms (
N 317 N-units, a 8766 Climate maritime temperate overla	km. Surface typ .md	de	kın
Frequency 573.2 MHz, Transmitt			dBW
Δh 87.5 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	290	64	
gain [dBi], main beam			
height [m], above site surface		9.1	
line loss [dB]			
polarization	К	<u> </u>	
type			
Horizon distance [km]		1.64	
elevation [m-msl]		61	
elevation angle [deg]		·	
Location, latitude	51°25'20"N	52° 30' 26"N	
longitude	0°04'17"W	0°20'30"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 153. Path 11982, parameters.

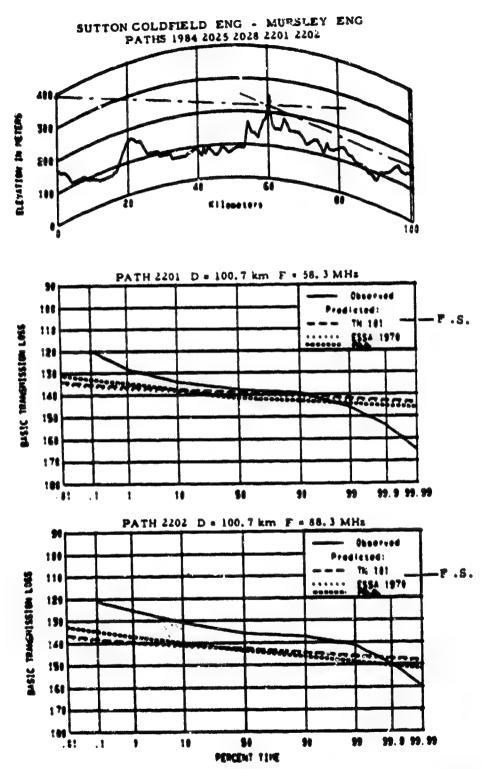


Figure 154. Paths 12201 and 12202, profile and predictions.

Code Number: 1 1 2 0 2 1 0 Location: Sutton Coldfield, Eng. Data type 1418 hourly medians	, Distance 10	3 1 1 1 ingland 00.7 km,h 120	m-ms l
N _s 313 N-units, a 8694 Climate maritime temperate overlan	_km, Surface typ d	e average ground	km
Frequency 58.2 MHz, Transmitte	er output	dBW, EIRP	dBW
Δh 92.1 m. θ mr.			
Antenna elevation [m-msl]	Transmitter 393.2	Receiver 167	
gain (dBi), main beam () height (m), above site surface		8.5	
line loss [dB] polarization	Н	Н	
type Horizon distance (km)		40.36	
elevation [m-ms1]		216.4	
elevation angle [deg] Location, latitude	52° 35' 59"N	51°57'12"N	
longitude	1049.57"0	0°48'05"W	
Path bearing elevation [m-ms1]			

Figure 155. Path 12201, parameters.

Path Number:	1 2 2 0	2	
Code Number: 1 1 2 0 2 1 0	4 5 2 1 1	3 1 1 1	
Location: Sutton Coldfield, Eng	gland - Mursley,	England	
Data type 1441 hourly medians	, Distance10	0.7 km, h 120	m-ms1
N _s 313 N-units, a 8694			***************************************
Climate maritime temperate overli	and	, de	km
Frequency 88.3 MHz, Transmitt	ter output	dBW, EIRP	dBW
Δh 92.1 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	365.8	167	
gain [dBi], main beam			
height [m], above site surface		8.5	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		40.36	
elevation [m-msl]		216.4	
elevation angle [deg]			
Location, latitude	52° 35' 59"N	51°57'12"N	
longitude	1°49'57"W	0°48'05"W	
Path bearing			
elevation [m=ms1]			
Other information:			

Figure 156. Path 12202, parameters.

SUTTON COLDFIELD ENG - MURSLEY ENG

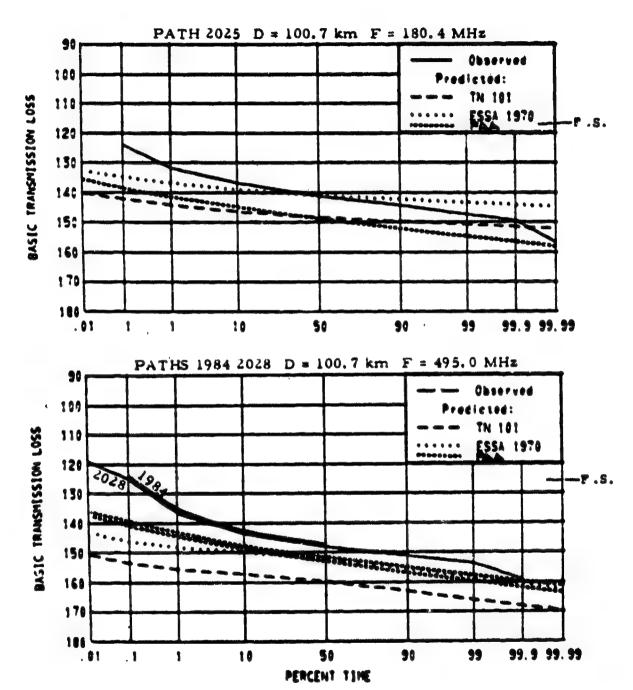


Figure 157. Paths 12025, 11984, and 12028, predictions. (see Figure 154 for profile)

Path Number:	1 2 0 2	5	
Code Number: 1 1 2 1 2 1 0	4 5 2 1 1	3111	
Location: Sutton Coldfield, Eng			
Data type 5243 hourly medians	_, Distance10	0.7 km.h _{rs} 120	m-ms1
N 313 H-units, a 8694	km, Surface typ	e average ground	
Climate maritime temperate overlan	nd .	de	km
Frequency 180.4 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 92.1 m. θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	348.1	167.1	
gain [dBi], main beam			
height [m], above site surface		8.6	
line loss [dB]		,	
polarization	Н	Н	
type			
Horizon distance [km]		40.36	
elevation [m-msl]		216.4	
elevation angle [deg]			
Location, latitude	52 ⁰ 35'59"N	51°57'12"N	
longitude	1°49'57"W	0°48'05"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 158. Path 12025, parameters.

Path Number:			
Code Number: 1 1 2 4 2 1 0	4 5 2 1 1	3 1 1 1	
Location: Sutton Coldfield, Eng			
Data type 3143 howrly medians	_, Distance100	120 km, hrs 120	m-ins l
N 313 N-units a 8694	km, Surface typ	e average ground	
Climate maritime temperate overla	ind .	de	km
Frequency 495 MHz, Transmitte			dBW
Ah 92.1 m, 6 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	394.7	167.6	
gain [dBi], main beam			
height [m], above site surface		9.1	
· · ·			
line loss [dB]	Н	Н	
polarization		***	
type		40.36	
Horizon distance [km]			
elevation [m-ms1]		216.4	
elevation angle [deg]			
Location, latitude	52°35'59"N	51°57'12"N	
longitude	1°49'57"W	0°48'05"W	
Path bearing	-		
elevation [m-ms1]			
Orbon Informations			

OT/TRER 16, fig. 2.6

Figure 159. Path 11984, parameters.

Path Number:	_1 2 0 2	1	
Code Number: 1 1 2 4 2 1 0	4 5 2 1 1	3111	
Location: Sutton Coldfield, Eng	land - Mursley, l	ingland	
Data type 3143 hourly medians	_, Distance	km, h	m-ms l
N _s 313 N-units, a 8694	km, Surface typ	e average ground	
Climate maritime temperate overli			km
Frequency 495 MHz, Transmitt	er output	dew, EIRP	
Ah 92.1 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	349.9	167	
gain [dBi], main beam			
height [m], above site surface		8.5	
line loss [dB]	The state of the s		
polarization	Н	<u> </u>	
type			
Horizon distance [km]		40.36	
elevation [m-msi]		216.4	
elevation angle [deg]		2.0.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2	
Location, latitude	52° 35' 59"N	51°57'12"N	
longitude	1°49'57"W	0°48 * 05"W	
Path bearing	Appropriate and the Enderthe Serve A a recovery development	A fillion . Co. C. or refer destillately for all the Physics. Material Spirits.	
elevation [m=ms1]	and on a second	s s as another decreases an expensive decreases decreases	
Other information:			

OT/TRER 16, fig. 2.6

Figure 160. Path 12028, parameters.

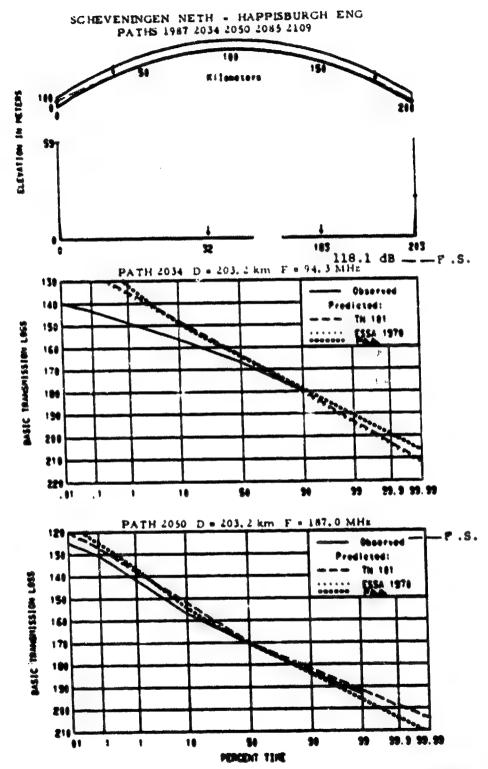


Figure 161. Paths 12034 and 12050, profile and predictions.

	1 2 0 3		
Code Number: 1 1 2 0 3			
Location: Scheveningen, N			
Data type 5541 hourly med	ians Distance 203	.Z km, hrs	m-ms l
N 318 N-units, a	8784 km, Surface typ	pe sea water	
Climate martime temperate o			km
Frequency 94.4 MHz, Tran	smitter output	dBW, EIRP	dBW
.th 0 m, θ	mr,		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	24.4	
gain [dBi], main beam			,
height [m], above site surfa	oce	9.2	
line loss [dB]			•
polarization	H	<u> </u>	
*ype			
Horizon distance [km]	And the last of th		
elevation [m-ms]]			•
elevation angle [deg]			
Location, latitude	52°06'N	52 ⁰ 49'42"N	•
longitude	4º16'E	1°31 ' 38"E	•
Path bearing	appalanten about allandariane de de de la		•
elevation [m-msl]	AND THE PROPERTY OF THE PROPER	a sandardin dire sarah ra, ayanggana-majanganin-direksinindireksi direksi	NA.
Other Internations			

Figure 162. Path 12034, parameters.

Path Number: Code Number: 1 1 2 1 3 0 0 Location: Scheveningen, Nethe 6380 hourly medians N. 318 N-units, a 8784	4 5 3 1 1 rlands - Happisbu , Distance 203.	3 4 1 1 rgh, England 2 km,h 0	m-ms 1
Climate maritime temperate overs	ea	de	km
Frequency 187 MHz, Transmitt			dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	24.4	
gain [dBi], main beam			
height [m], above site surface		9.2	
line loss [dB]			,
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle (deg)			
Location, latitude	52°06'N	52°45'42"N	•
long i tude	4º16'E	1º31'38"E	•
Path bearing			•
elevation [m-ms1]			
Other information:			

Figure 163. Path 12050, parameters.

SCHEVENINGEN NETH - HAPPISBURGH ENG

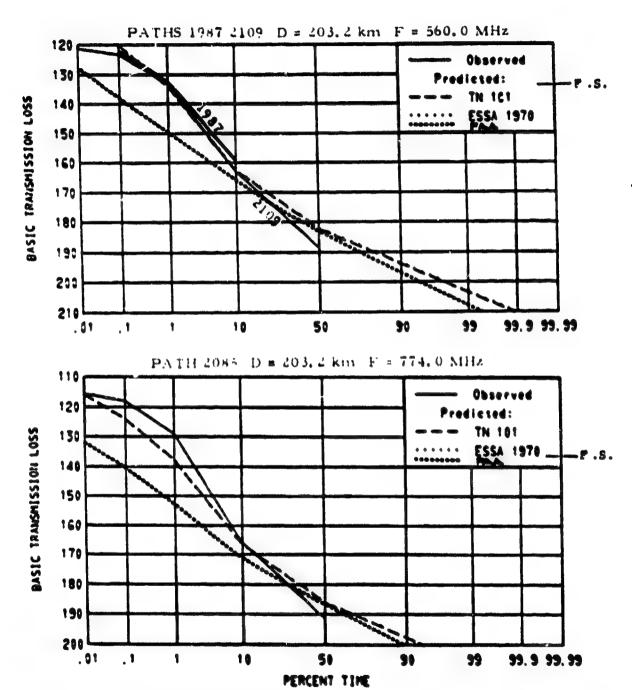


Figure 164. Paths 11987, 12109, and 12085, predictions. (see Figure 161 for profile)

Code Number:	Path Number: 1 1 2 5 3 0 0 Scheveningen, Nether	1 1 9 8 1 4 5 3 1 1 vrlands - Happisbu	3 4 1 1	
	6255 hourly medians			m-ms l
N 318	N-ynits, a 8784	km, Surface typ	se sea water	
5	time temperate overs			km
Frequency 56	O MHz, Transmit	ter output	dBW, EIRP	dBW
4h 0	m, B mr.			
		Transmitter	Receiver	
Antenna eleva	tion [m-ms1]	60.6	24.4	
gain [dBi],	main beam			
height [m],	above site surface		9.2	
line loss [d 8]			ı
polarizațio	n	Н	Н	ı
type				,
<u>Horizon</u> dista	nce [km]			,
elevation [m-ms1]			
elevation a	ngle [deq]			
Location, lat	i tude	52°06'N	52°49'42"N	
longitude		4º16'E	1031 38"E	
Path bearing elevation [m-ms 1]			
Other informa	ition:			

Figure 165. Path 11987, parameters.

Path Number:	1 210	9	
Code Number: 1 1 2 5 3	0045311	3411	
Location: Scheveningen, N			
Data type 9340 hourly med	lians Distance 20:	3.2 km, h _{rs} 0	m-ms 1
N 318 N-units, a	8784 km, Surface ty	pe <u>sea water</u>	
Climate maritime temperate	oversea	, de	
Frequency 560 MHz, Tra	nsmitter output	dBW, EIRP	dBW
Δh 0 m, 0	mr.		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	24.4	
qain [dBi], main beam			
height [m], above site surf	ace	9.2	
line loss [dB]			•
polarization	Н	Н	-
type			-
Horizon distance [km]			-
elevation [m-msl]			-
elevation angle [deg]			-
Location, latitude	52°06'N	52°49'42"N	_
longitude	4º16'E	1°31'38"E	_
Path bearing			-
elevation [m=msl]			
Other information:			

Figure 166. Path 12109, parameters.

Path Number: Code Number: 1 1 2 1 3 0 0 Location: Scheveningen, Netherl Data type 1119 howrly medians	4 5 3 1 1 ands - Happisburg Distance 203.	3 4 1 1 h, England 2 km,h 0	m-ms 1
N 318 N-units, a 8784	km, Surface typ	e sea water	km
Climate maritime temperate overse Frequency 774 MHz, Transmitt	<u> </u>		dBW
$\Delta h = 0$ m, $\theta = mr$.			
	Transmitter	——·	
Antenna elevation [m-ms1]	59.4	24.4	
gain [dBi], main beam			
height [m], above site surface		9.2	
line loss [dB]			
polarization	H	Н	
type			
Horizon distance [km]			,
elevation [m-msl]			•
elevation angle (deg)		52°49'42"N	•
Location, latitude	52°06'N	1031'34"E	•
longitude	4°16'E	1-31-38"E	•
Path bearing			-
elevation [m-ms1]			
Other information:			

Figure 167. Path 12085, parameters.

PATH 1988 SCHEVENINGEN NETH - TACOLNESTON ENG

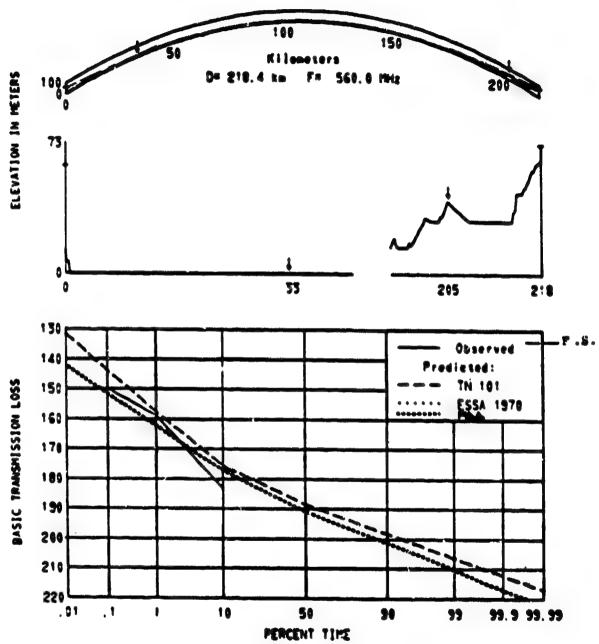


Figure 168. Path 11988, profile and predictions.

Path Number: Code Number: 1 1 2 5 3 0 C Location: Scheveningen, Nether Data type 6254 hourly medians	lands - Tacolness , Distance 218.	3 4 1 1 on, England 4 km,h 0	m-ms l
N 317 N-units, a \$766 Climate maritime temperate overla	km, Surface typ and	de	km
Frequency 560 MHz, Transmitt	ter output	dBW, EIRP	dBW
Λh 16.7 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	60.6		
gain [dBi], main beam			
height [m], above site surface		9.1	
line loss [dB]		Н	
polarization	Н		•
type		13.7	•
Horizon distance [km]		41	•
elevation [m-msl]		7	-
elevation angle (deg)	52° Q6' N	52°31'03"N	-
Location, latitude	4º 16'E	1°08'25"E	_
long i tude			_
Path bearing elevation [m-msl]			-
Other information:			

Figure 169. Path 11988, parameters.



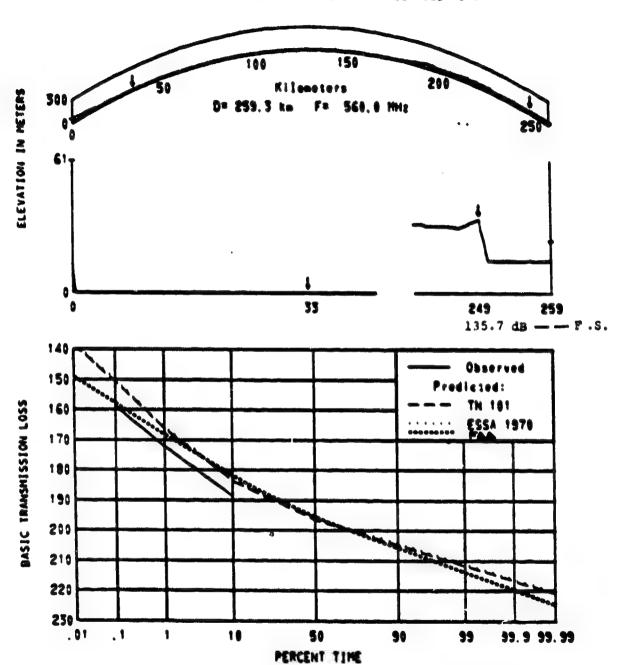


Figure 170. Path 11989, profile and predictions.

Transmitter output	Path Number: Code Number: 1 1 2 5 3 0 0 Location: Scheveningen, Netherle Data type 5849 hourly medians N 317 N-units, a 8766 Climate maritime temperate overlan	ands - Feltwell, _, Distance_259.3 _km, Surface typed	km,h, 0 average ground de	m-ms 1 km
Ah 30.6 m, θ mr. Antenna elevation [m-ms1] 60.6 24.3 gain [dBi], main beam 9.1 height [m], above site surface 9.1 line loss [dB] H H polarization H H type 10.1 10.1 elevation [m-ms1] 34 10.1 elevation angle [deg] 52°28'50"N 52°28'50"N Location, latitude 4°16'E 0°51'15"E	Frequency 560 MHz, Transmitte	er output	dBW, EIRP	dBW
Antenna elevation [m-ms1] 60.6 24.3 gain [dBi], main beam height [m], above site surface line loss [dB] polarization type Morizon distance [km] elevation [m-ms1] elevation angle [deg] Location, latitude longitude 60.6 24.3 40.6 10.1 52.0 52.0 52.0 52.0 52.0 53.1 53.1 53.1 54.1 55.0 56.6 75.1				
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface line loss [dB] polarization type Horizon distance [km] elevation [m-ms1] elevation angle [deg] Location, latitude longitude 10.1 52°06'N 52°28'50"N 4°16'E 0°51'15"E		Transmitter		
gain [dBi], main beam 9.1 height [m], above site surface 9.1 line loss [dB] H polarization H type 10.1 Horizon distance [km] 34 elevation [m-ms1] 34 elevation angle [deg] 52°28'50"N Location, latitude 4°16'E 0°31'15"E	Antenna elevation [m-ms1]	60.6	24.3	
height [m], above site surface line loss [dB] polarization type Horizon distance [km] elevation [m-ms1] elevation angle [deg] Location, latitude longitude loss [dB] H H H Solution 10.1 52°28'50"N 60'51'15"E				
H	_		9.1	
type Horizon distance [km] elevation [m-ms1] elevation angle [deg] Location, latitude longitude 10.1 34 52°06!N 52°28'50"N 0°31'15"E	line loss [dB]			
Horizon distance [km] 10.1	polarization	Н	Н	
Elevation distance [km] 34	type		44.4	
Elevation angle [deg]	Horizon distance [km]		10.1	
Location, latitude 52°06'N 52°28'50"N longitude 4°16'E 0°31'15"E	elevation [m-ms1]			
longitude 4°16'E 0°31'15"E	elevation angle [deg]		0	
longitude	Location, latitude			
Path bearing	longitude	4°16'E	0 31,12,6	
	Path bearing			
elevation [m-ms1]				

Figure 171. Path 11989, parameters.



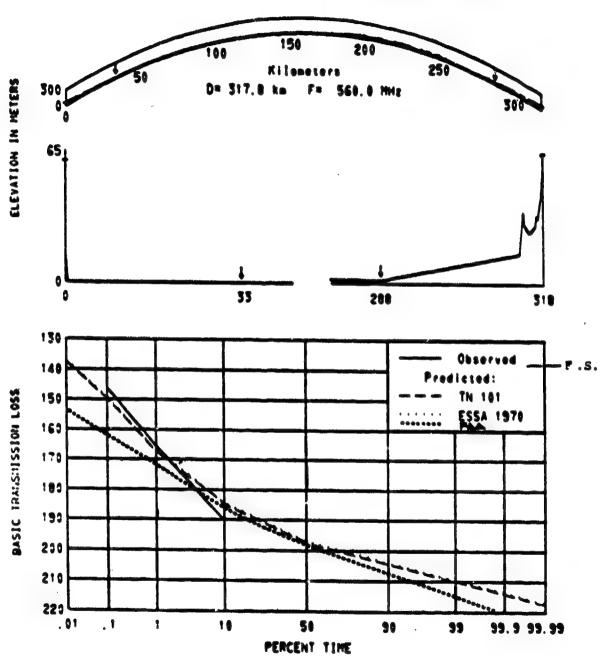
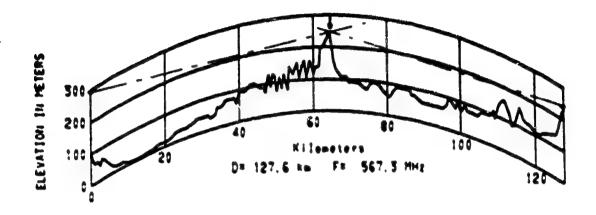


Figure 172. Path 11990, profile and predictions.

Code Number: 1 1 2 5 3 0 0 Cocation: Scheveningen, Nether Data type 5630 hourly medians 318 N-units, a 8784	, Distance	3 4 1 1 Hill, England 8 km,h 1.5 e average ground	m-ms 1
climate marcitume temperate over	CCMPM		km
Frequency 560 MHz, Transmitt	ter output	dBW, EIRP	dBW
Λh 36.9 m, θ mr.			
	Transmitter	Receiver	; ł
Antenna elevation [m-msl]	60.6	65.2	: '
gain [dBi], main beam			
height [m], above site surface		9.1	
line loss [dB]			
polarization	Н	H	
type			
Horizon distance [km]		30.3	
elevation [m-msi]		1.5	
elevation angle [deg]			
Location, latitude	52°06'N	52° 30' 26"N	
longitude	4º16'E	0°20'30"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 173. Path 11990, parameters.



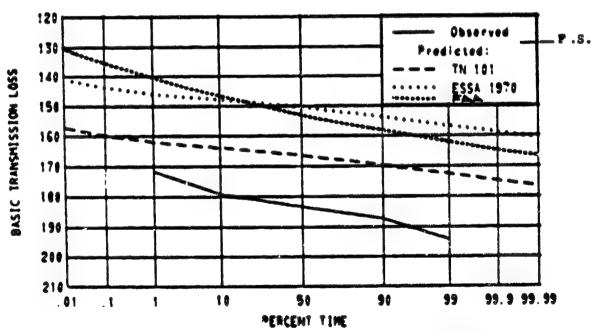


Figure 174. Path 11998, profile and predictions.

	Path Number:	1 1 9 9	8	
Code Number:	1 1 2 5 2 1 0	4 5 2 1 1	$\frac{3}{3} \frac{1}{2} \frac{1}{2} \frac{1}{3} \frac{1}{3}$,
Location:	Crystal Palace, Engl	land - Stow on th	e woza, Englana	
Data type	6000 hourly medians		.6 km, h 100	m-ms 1
N 313	N-units, a 8694	km, Surface typ	e average ground	
Climate mari	itime temperate overla	nd	de	km
Frequency 567	7.2 MHz, Transmitt	ter output	dBW, EIRP	dBW
	m, 0 mr.			
		Transmitter	Receiver	
Antenna eleva	tion [m-ms1]	294.1	240.7	
-	, main beam			
•	, above site surface		9.1	
line loss	[dB]			
polarizatio	on	Н	Н,	
type	parents 4.		62.89	
Horizon dist	ance [km]			
elevation	[m-ms1]		245.4	
elevation	angle [deg]		51°55'42"N	
Location, la	t i tude	51°25'20"N		
longitude		0°04'17"W	1°43'30"W	
Path bearing				
elevation	[m-ms1]		en englande altrediteige van hyddigestjertje eithe tie der engalderities	
Other inform	ation:			

Figure 175. Path 11998, parameters.

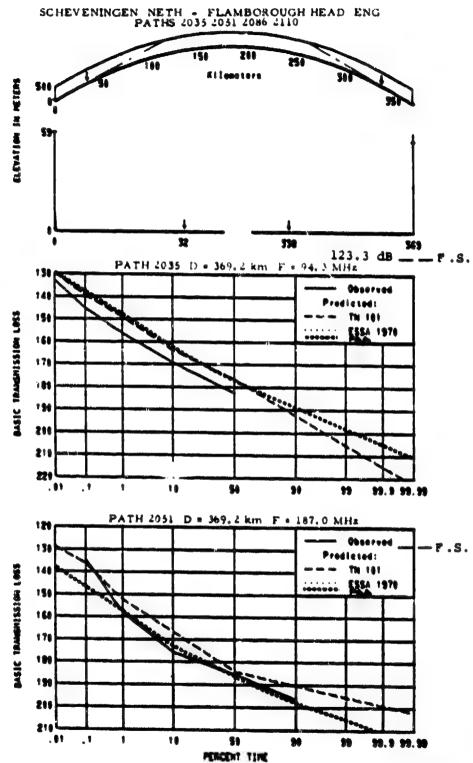


Figure 176. Paths 12035 and 12051, profile and predictions.

Path Number: Code Number: 1 1 2 0 3 0 0 Location: Scheveningen, Netherly Data type 5589 hourly medians No 317 N-units, a 8766 Climate maritime temperate overs	4 5 3 1 1 ands - Flamboroug Distance 36 km, Surface typ	3 4 1 1 h Head, England 69.2 km, h _{rs} 0 e seawater	m-ms l
Frequency 94.4 MHz, Transmitt			dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	54.9	
gain [dBi], main beam-			
height [m], above site surface		9.2	
line loss [dB]			
polarization	Н	<u> </u>	
type			
Horizon distance [km]			
elevation (m-msl)			
elevation angle [deg]	2000000	54°07'39"N	
Location, latitude	52°06'N		
longitude	4º16'F	0°05'40"W	
Path bearing			
elevation [m-msl]		a ganda segua silpantina silpa kilo hippaga paradhan san daki ka tiba disabiliran	
Other information:			

Figure 177. Path 12035, parameters.

Path Number:			
Code Number: 1 1 2 1 3 0 0 Location: Scheveningen, Nether	4 5 3 1 1 Lands - Flamborou	3 4 1 1 oh Heud. England	
			m-ms 1
Data type 6819 hourly medians	, Distance 307	· z Km, nrs	
N _s 377 N-units, a 8766	km, Surface typ	e <u>seawater</u>	km
Climate maritime temperate overs	· ·	4014 5400	dew
Frequency 187 MHz, Transmitt	er output	dbw, ETRP	Q D W
$h = 0$ m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m=ms1]	59.4	54.9	
gain [dBi], main beam			
height [m], above site surface		9.2	•
line loss [dB]			•
polarization	Н	Н	•
type			•
Horizon distance [km]			•
elevation [m-ms]]			-
elevation angle (deg)		0	149
Location, latitude	52°06'N	54°07°39"N	-
longitude	4º16'E	0°05'40"W	1049
Path bearing			-
elevation [m-msl]		-	jan.
Other Information:			

Figure 178. Path 12051, parameters.

SCHEVENINGEN NETH - FLAMBOROUGH HEAD ENG

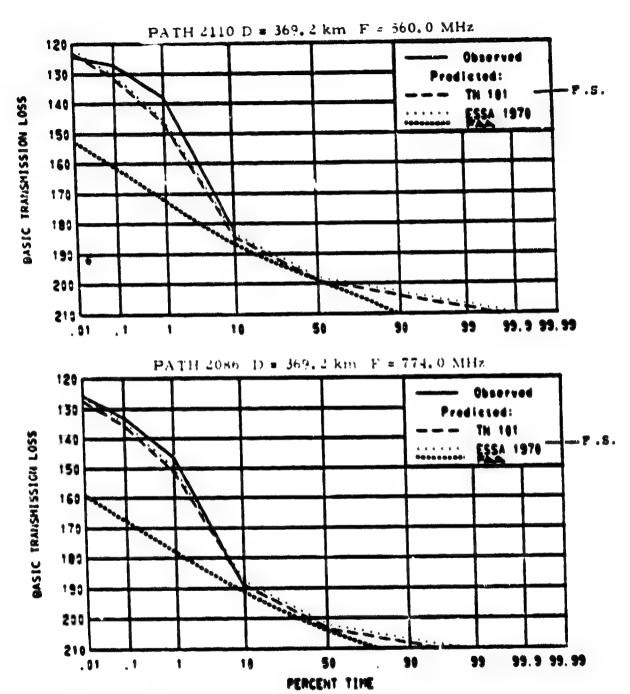


Figure 179. Paths 12110 and 12086, predictions. (see Figure 176 for profile)

Location: Scheveningen, Nether Pata type 9603 hourly medians N 317 N-units, a \$766	, Distance 369.	km, hrs	m-ms 1
Climate maritime temperate overse	a		km
Frequency 560 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	54.9	
gain [dBi], main beam			
height [m], above site surface		9.2	
line lass (dB)			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	52°96'N	54°07'39"N	
longitude	4º16'E	0°05'40"W	•
Path bearing			
clevation [m-ms1]		ger - Mark - man - March affi i 16 i 1 15 glafeinden aller der 160 der Bertremilier d	
Other information:			

Figure 180. Path 12110, parameters.

Path Humber:	_1201	_6	
Code Number: 1 1 2 7 3 0 0	4 5 3 1 1	3411	
Location: Scheveningen, Nether	lands - Flamborou	igh Head, England	
Data type 1123 hourly medians	, Distance 30	km, hrs	m-ms l
N 317 N-units, a 8766			
Climate maritime temperate oversea			km
Frequency 774 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 0 m, θ mr.			• ,
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	54.9	
gain [dBi], main beam			
height [m], above site surface		9.2	
line loss [dB]			
polarization	Н	. <u>H</u>	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude	52°06'N	54°07'39"N	
longitude	4º16'E	0°05'40"W	,
Path bearing			•
elevation [m=ms1]			
Other information:			

Figure 181. Path 12086, parameters.

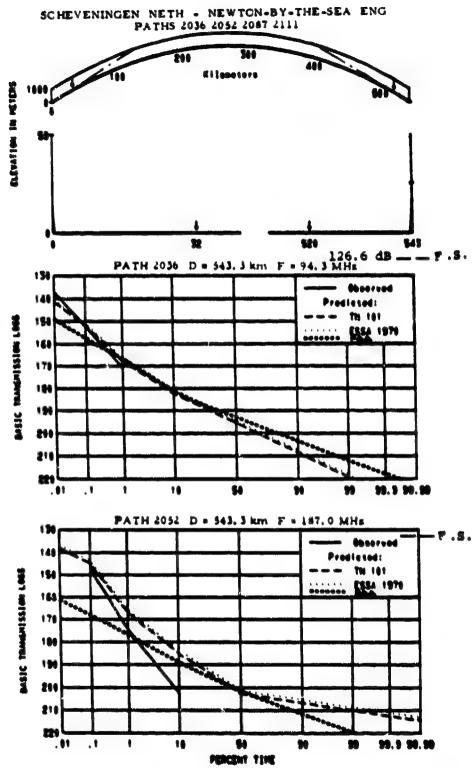


Figure 182. Paths 12036 and 12052, profile and predictions.

Code Number: 1 1 2 0 3 0 0 Location: Scheveningen, Netherl Data type 5541 hourly medians N 317 N-units, a 1766 maritime temperate overs	_, Distance543 _km, Surface ty	3 4 1 1 y the Sea, England 3 km,h, 0 pe_seawater de	m-ms l
Frequency 94.4 MHz. Transmitt	er output	dBW, EIRP	dBW
Antenna elevation [m-ms1]	Transmitter 59.4	Receiver 30.5	
gain [dBi], main beam		9.2	
height [m], above site surface		7 . 6	
line loss [dB] polarization	H	Н	
type			
Horizon distance [km] elevation [m-msl]			
elevation angle (deg) Location, latitude longitude	52°06'N 4°16'E	55° 31 '06"N 1° 37 '05"W	
Path bearing clevation [m-ms1] Other information:			-

Figure 183. Path 12036, parameters.

Path Number: Code Number: 1 1 2 1 3 0 0 Location: Scheveningen, Nether Data type 6010 hourly medians N 317 N-units, a 8766	4 5 3 1 1 lands - Newton by , Distance 543	3 4 1 1 the Sea, England .3 km, h 0	m-ms1
Climate maritime temperate overs	ea	de	km
Frequency 187 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
Additional Control of the Control of	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	30.5	
gain [dBi], main beam			
height [m], above site surface		9,2	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance (km)			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude	52°06'N	55° 31' 06"N	
longitude	4º 16'E	1°37'05"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 184. Path 12052, parameters.

SCHEVENINGEN NETH - NEWTON-BY-THE-SEA ENG

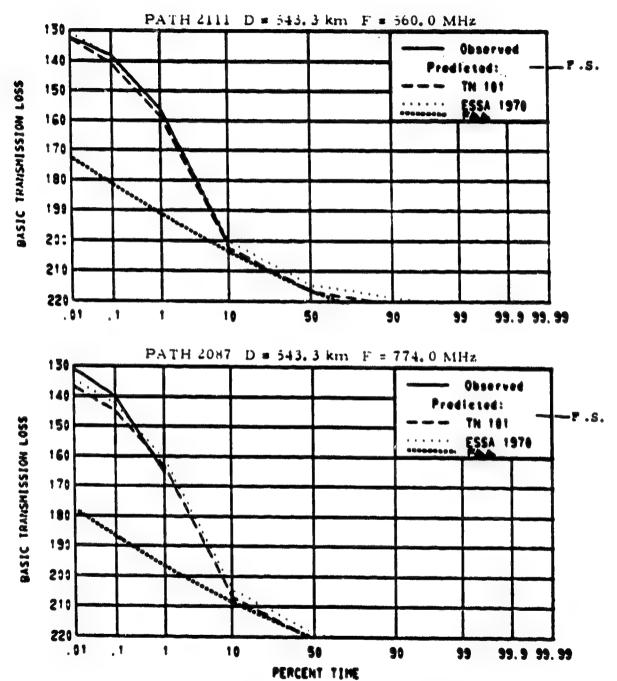


Figure 185. Paths 12111 and 12087, predictions. (see Figure 182 for profile)

Path Number: Location: 1 1 2 5 3 0 0 Location: Scheveningen, Nether Bata type 8862 hourly medians N. 317 N-units, a 876	tands - Newton by Newton by Newton by Surface type	the Sea, England .3 km,h seawater	m-ms1
maritime temperate overs	ea .	06	km
Frequency 560 MHz, Transmitt	er output	dBW, EIRP	dBW
th 0 m, 0 mr.			
	Transmitter	Receiver	
Acception [manuel]	59.4	30.5	
Antenna elevation [m-ms1]			
gain [dBi], main beam		9.2	
height [m], above site surface			
line loss [dB]	Н	Н	
polarization			
type			
Horizon distance [km]			
elevation [m-ms1]	المستر والمسترد والمسترد والمسترد والمسترد والمسترد		
clevation angle [deg]		55° 31' 06"N	
Location, latitude	52°06'N	1°37'05"W	
long i tude	4º16'E	1 37 03 0	
Path bearing			
elevation [m-ms1]			•
Other information:			

Figure 186. Path 12111, parameters.

Path Number:	1 2 0 8	7	
Code Number: 1 1 2 7 3 0 0	4 5 3 1 1	3 4 1 1	
Location: Scheveningen, Nether	lands - Newton by	the Sea, England	
Data type 1059 hourly medians	, Distance54	13.3 km, h 0	m-ms l
N ₂ 317 N-units, a 8766	km, Surface typ	e seawater	
Climate maritime temperate overse	a	de	km
Frequency 774 MHz, Transmitt	er output	dBW, EIRP	dBW
5h 0 m, 9 mr.	,		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	30.5	
gain [dBi], main beam			
height [m], above site surface		9.2	
line loss [dB]			
polarization	Н	н	
type			
Horizon distance [km]			
elevation [m-ms1]			,
elevation angle [deg]			•
Location, latitude	52°06'N	55° 31' 06"N	
longitude	4º16'E	1037'05"W	•
Path bearing			•
elevation [m-ms1]			
Oabus information:			•

Figure 187. Path 12087, parameters.

SCHEVENINGEN NETH - LERWICK SHETLAND IS PATHS 2038 2054 2113

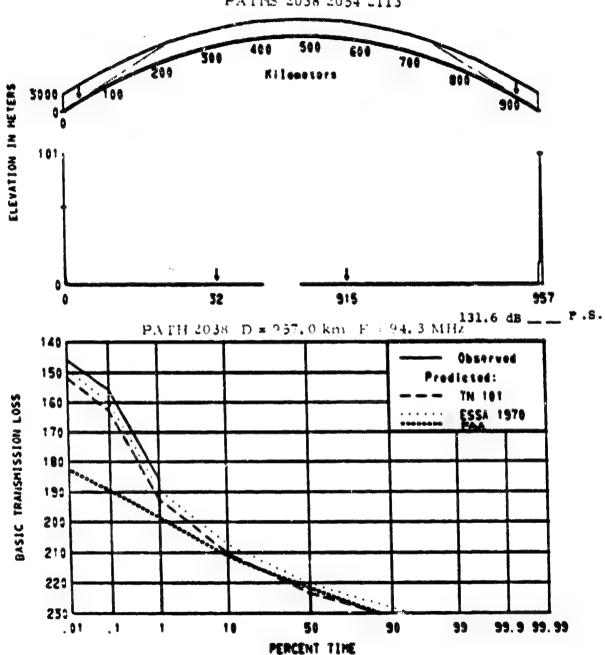


Figure 188. Path 12038, profile and predictions.

Path Number: Code Number: 1 1 2 0 3 0 0 Location: Scheveningen, Nether	4 5 3 1 1	3 4 1 1	
Data type 5679 hourly medians	Distance 957.	.0 km,h 0	m-ms l
N 318 N-units, a 8784	km Surface tvi	e seawater	
Climate maritime temperate overs	ea	de	km
Frequency 94.4 MHz, Transmitt	er output	dBW, EIRP	dBW
Mh 0 m, 6 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	100.6	
gain [dBi], main beam			
height [m], above site surface	46		
line loss [dB]	-		
polarization	Н	Н	•
type			
Horizon distance [km]			
elevation [m-msi]			-
elevation angle [deg]			
Location, latitude	52°06'N	60°08'11"N	-
longitude	4º16'E	1°10'46"W	-
Path bearing			-
elevation [m-msl]			-
Other information:			

Figure 189. Path 12038, parameters.

SCHEVENINGEN NETH - LERWICK SHETLAND IS

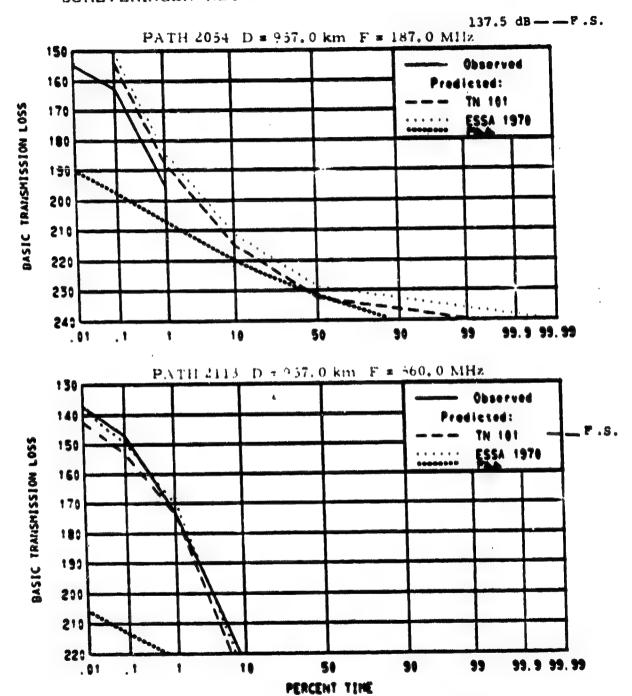


Figure 190. Paths 12054 and 12113, predictions. (see Figure 188 for profile)

Path Number: Code Number: 1 1 2 1 3 0 0 Location: Scheveningen, Nether	<u>4 5 3 1 1</u> lands - Lerwick,	3 4 1 1 Shetland Islands	m~m≤1
Data type 6845 hourly medians N. 318 N-units, a 8784			
3			km
Climate <u>maritime temperate overse</u> Frequency <u>187</u> MHz, Transmitt			
$\Delta h = 0$ m, $\theta = mr$.	ter output		
	Transmitter	Receiver	
Antenna elevation [m-msl]	59.4	100.6	
gain [dBi], main beam			
height [m], above site surface	46		
line loss [dB]			
polarization	Н	<u> </u>	
type			
Horizon distance [km]			
elevation [m-ms]]			
elevation angle [deg]			
Location, latitude	52°06'N	60°08'11"N	i .
longitude	4º16'E	1010'46"W	
Path bearing			
elevation [m-msl]			,
Oak a lafaamaklaa			

Figure 191. Path 12054, parameters.

Path Number:	1 2 1 1	3	
Code Number: 1 1 2 5 3 0 0	4 5 3 1 1	3 4 1 1	
Location: Scheveningen, Netherl	lands - Lerwick, S	hetland Islands	
Data type 9696 hourly medians	_, Distance <u>95</u>	7.0 . km, h	m-ms l
N 318 N-units, a 8784	km, Surface typ	e sea water	
Climate maritime temperate overs	ea	de	km
Frequency 560 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	100.6	
gain [dBi], main beam			
height [m], above site surface	46		
line loss [dB]			
polarization	<u> </u>	Н	ı
type			
Horizon distance (km)			,
elevation [m-msl]			
elevation angle [deq]		400 444 444	
Location, latitude	52°06'N	60°08'11N	4
langitude	4°16'E	1°10'46"W	
Path bearing	Company of the Compan	allegen geralde. Gertlich ser regertlijnsprinsk-rette den d. v. ville reflik blieb	**
elevation [m-ms1]	-	ganda allan disentanta neperapagan dan dan di peperapakan dan	
Other Information;			

Figure 192. Path 12113, parameters.

PATHS 2043 2048 2104 PONTOP PIKE ENG - KINGSWOOD ENG

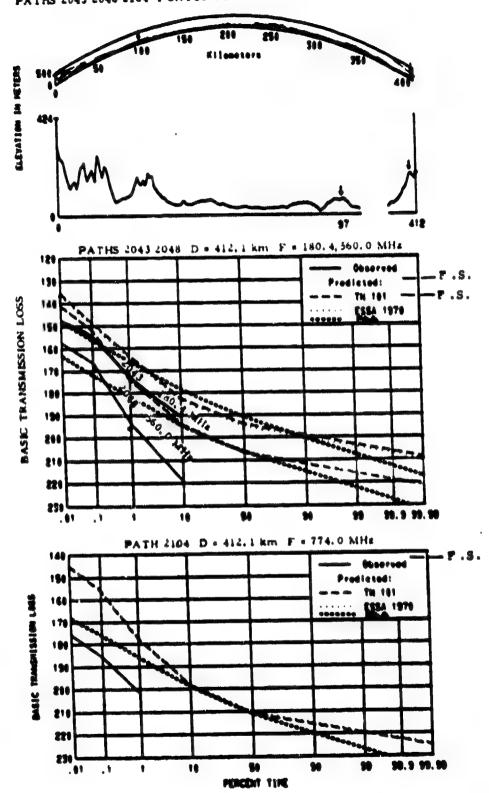


Figure 193. Paths 12043, 12048, and 12104, profile and predictions.

Path Number: Code Number: 1 1 2 1 3 0 0 Location: Pontop Pike, England Data type 3197 hourly medians N. 316 N-units, a 8747 Climate maritime temperate overland	4 5 2 1 1 - Kingswood, Eng , Distance 41 _km, Surface typ	3 1 1 1 land 2.1 km, h 67.1 e average ground	m-ms 1
Frequency 180.4 MHz, Transmitte	er output	dBW, EIRP	d bw
	Transmitter	Receiver	
Antenna elevation [m-ms1]	424.3	176.2	
gain [dBi], main beam			
height [m], above site surface		8.6	
line loss [dB]			
polarization	н	н	
type			
Horizon distance [km]		2.25	
elevation [m-msl]		176.5	
elevation angle [deg]			
Location, latitude	54°52'08"N	51°17'20"N	
longitude	1046'11"W	0°12'50"W	
Path bearing			
elevation [m-msl]			
Other information:			•

Figure 194. Path 12043, parameters.

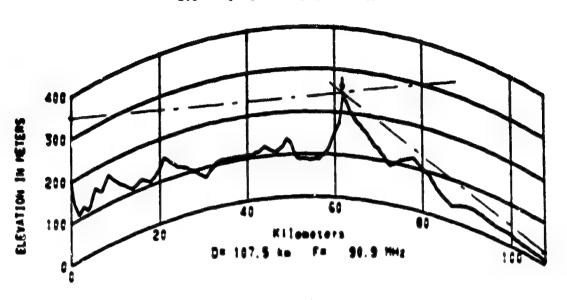
Path Number: Code Number: 1 1 2 5 3 0 0 Location: Pontop Pike, England Data type 3545 hourly medians N 316 N-units, a 8747	1 4 5 2 1 1 1 - Kingswood, Engage , Distance 412 km, Surface typ	3 1 1 1 land .1 km,h 67.1 e average ground	m-ms1
climan maritime temperate overla	na .	96	JBW
Frequency 560 MHz, Transmit	ter output	den, Elki	
	Transmitter	Receiver	
Antenna elevation [m-ms1]	430.4	176.2	
gain [dBi], main beam			
height [m], above site surface		8.6	
line loss [dB]		Н	ı
polarization	H	П	•
type		2.25	•
Horizon distance [km]		176.5	•
elevation [m-ms1]			_
elevation angle [deg]	54°52'08"N	51°17'20"N	_
Location, latitude longitude	1°46'11"W	0°12'50"W	-
Path bearing			-
elevation [m-ms1]			1 000
are an information:			

Figure 195. Path 12048, parameters.

	Path Number:	1_2_1_0	4	
Code Number:	1 1 2 7 3 0 0	4 5 2 1 1	3 1 1 1	
Location:	Pontop Pike, England	- Kingswood, Eng	land	
Data type	8728 hourly medians	, Distance 41	2.1 km,h 67.1	m-ms 1
N 316	N-units, a_ 8747	km, Surface typ	e average ground	
	time temperate overlan			km
Frequency	774 MHz, Transmitt	er output	dBW, EIRP	_d8W
āh 128	m, 0mr.			
		Transmitter	Receiver	
Antenna eleva	tion [m-ms1]	427.3	176.2	
gain [dBi],	main beam			
height [m],	above site surface		8.6	
line loss (dB)			
polarizatio	n	Н	Н	
type				
Horizon dista	nce [km]		2.25	
elevation [n-msl]		176.5	
elevation a	ngle [deg]			
Location, lat	i tude	54°52'08"N	51°17'20"N	
longitude	•	1º46'11"W	0°12°50"W	
Path bearing				
elevation [m-ms1]		anger a sight to requirement of the control of the	
Other Informa	tion			

Figure 196. Path 12104, parameters.





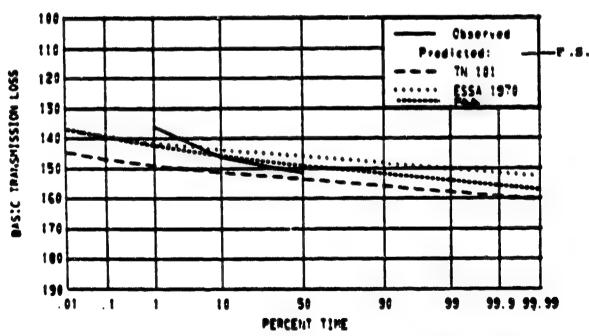
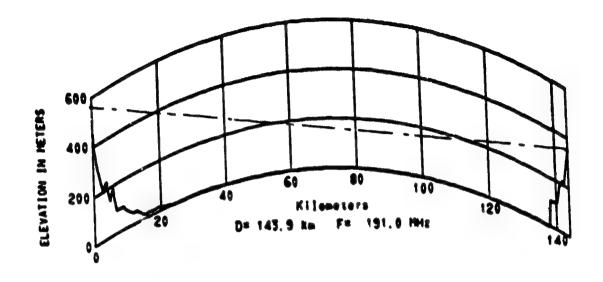


Figure 197. Path 12057, profile and predictions.

	Path Number:			
Code Number:	1 1 2 0 2 1 0	<u> </u>		
Location:	Daventry, England -	leadington, ingla		
Data type	6000 hourly medians	. Distance 107	km, h	m-ms 1
N 313	N-units, a 8694	km, Surface typ	e average ground	
Climate mar	itime temperate overla	ind .	de	km
Frequency 90.	9 MHz, Transmitt	er output	dew, EIRP	dBW
	m, 0 mr.			
•		Transmitter	Receiver	
Antenna eleva	tion [m-ms]]	349.9	27.0	
gain [dBi],				
-	above site surface		18.0	
line loss (
		Н	Н	•
polarizatio	n			
type	()		45.69	
Horizon dista			345.4	
elevation [1.40.4	
elevation a	ingle [deg]		2.0022.0484	
Location, lat	i tude	52°14'32"N	51°25'24"N	
longitude		1°09'24"W	0°19'54"W	
Path bearing				
elevation	[m-ms1]	-		
Other informa	etion:			

Figure 198. Path 12057, parameters.

PATHS 2075 2151 WINTER HILL ENG - DOUGLAS ISLE OF MAN



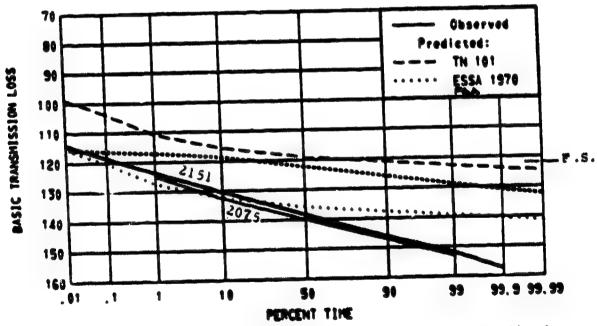


Figure 199. Paths 12075 and 12151, profile and predictions.

Path Number:	_ 1 2 0 7	5	
Code Number: 1 1 2 1 1 0 0	4 5 3 1 1	3 1 1 1	
Location: Winter Hill, England	- Douglas (high	site) Isle of Man	
Data type 5 months of hourly medians	Distance 14	3.9 km, h 0	m-ms 1
N 306 N-units, a 8574	km, Surface typ	e sea water	
Climate maritime temperate oversea			kni
Frequency 191 MHz, Transmitte	er output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	563.9	356.6	
gain [dBi], main beam			
height [m], above site surface		9.1	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		143.9	
elevation [m-msl]		457.2	
elevation angle [deg]			
Location, latitude	53 ⁰ 37'44"N	54°12'50"N	
long i t ude`.	2°30'55"W	4°28'00"W	
Path bearing			
elevation [m-msl]			
Oshun Informations			

OT/TRER 16, §ig. 1.24

Figure 200. Path 12075, parameters.

Path Number: Code Number: 1 1 2 1 1 0 0 Location: Winter Hill, England Data type 4200 hourly medians	4 5 3 1 1 - Pouglas (high , Distance 143.	3 1 1 1 site) Isle of Man 9 km,h 0	m-ms l
N 306 N-units, a 8574 Climate maritime temperate overs	ea	de	km
Frequency 191.2 MHz, Transmitte	er output	dBW, EIRP	dBW
Δh <u>0 m, θ</u> mr.			
Antenna elevation [m-msl]	Transmitter 580	<u>Receiver</u> 357.5	
gain [dBi], main beam height [m], above site surface		10	
line loss [dB] polarization	Н	Н	
<pre>Morizon distance [km] elevation [m-msl]</pre>		143.9 457.2	
elevation angle [deg] Location, latitude longitude	53 ⁰ 37'44"N 2 ⁰ 30'55"W	54 ⁰ 12'50"N 4 ⁰ 28'00"W	
Path bearing elevation [m-ms1] Other information:			- -

Figure 201. Path 12151, parameters.

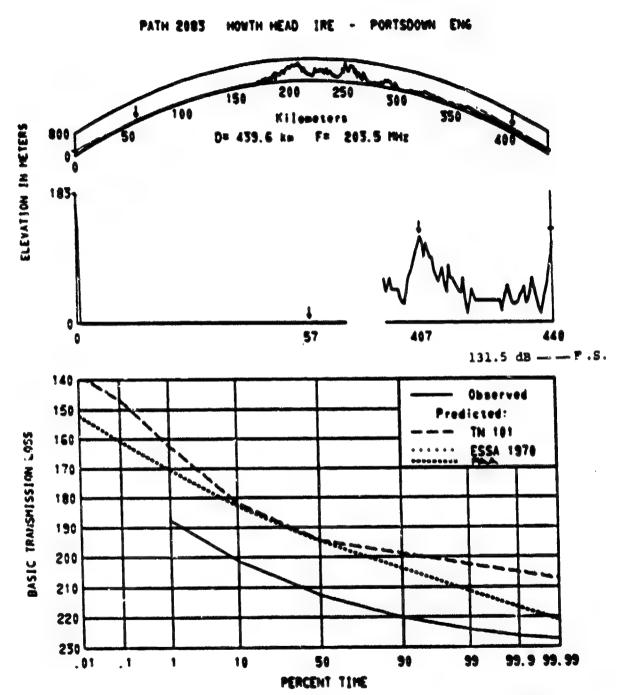


Figure 202. Path 12083, profile and predictions.

Path Number:	1 2 0 8	3	
Code Number: 1 1 2 2 3 0 0	4 5 2 1 1	3111	
Location: Howth Head, Ireland -	Portsdown, Engl	and	
Data type 271 hourly medians	Distance 43	9.6 km,h0	m-ms1
N _s 320 N-units, a 8822	_km, Surface typ	be average ground	<u></u>
Climate maritime temperate overla	ınd	de	km
Frequency 203.5 MHz, Transmitte	er output	dBW, EIRP	dBW
Ah 330.5 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	182.9	131.1	
gain [dBi], main beam			
height (m), above site surface		19.8	
line loss [dB]			
polarization	Н	Н	
• •			
type		32.5	
Horizon distance [km]		120.4	
elevation [m-ms]			
elevation angle [deg]	53°22'21"N	50°51°30"N	
Location, latitude		1°07'16"W	
longitude	6°04'04"W	1 0/ 10 %	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 203. Path 12083, parameters.

PATHS 2088 2112 SCHEVENINGEN NETH - BRIDGE OF DON SCOT

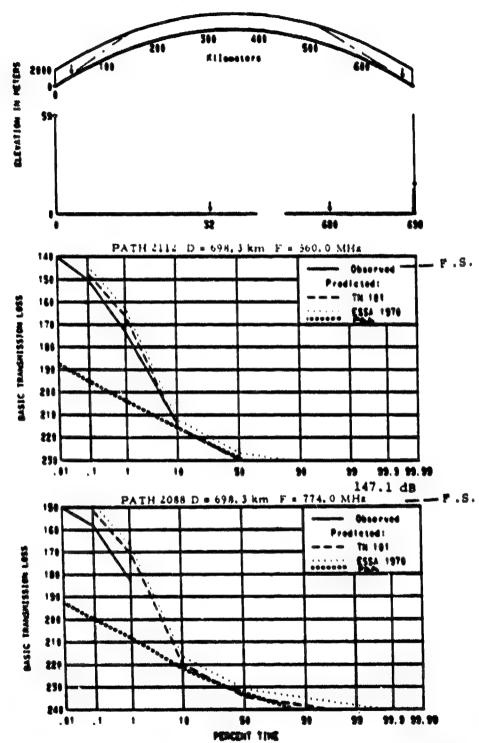


Figure 204. Paths 12112 and 12088, profile and predictions.

Path Number:	1211	2	
Code Number: 1 1 2 5 3 7 0 Location: Scheveningen, Neihers			
Data type 9783 hourly medians	, Distance 69	8.3 km.h.s 0	m-ms l
N ₂ 317 N-units, a 2766	km, Surface ty	pe sea water	
Climate maritime temperate overs	ea	, de	km
Frequency 560 MHz, Transmitte	er cutput	dBW, EIRP	dbw
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	18.5	
gain [dBi], main beam			
height [m], above site surface		9.2	
line loss [dB]			
polarization	Н	н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	52°06'N	57°10'40"N	
longitude	4º16'E	2 ⁰ 05'00"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 205. Path 12112, parameters.

Path Number:	$\frac{1}{0} \frac{1}{4} \frac{2}{5} \frac{0}{3} \frac{8}{1} \frac{1}{1}$	3 4 1 1	
Location: Scheveningen, Nethe	rlands - Bridge of	Don, Scotland	
Data type 1124 hourly medians	, Distance 69	8.3 km,h 0	m-ms l
N 317 N-units, a 876	6 km, Surface typ	e sea water	
Climate maritime temperate over	sea	de	km
Frequency 774 MHz, Transmit			d8W
Δh 0 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	59.4	18.3	
gain [dBi], main beam			
height [m], above site surface		9.2	
line loss [dB]			
polarization	<u> </u>	Н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude	52°06'N	57°10'40"N	
longitude	4º16'E	2°05'00"W	
Path bearing			
elevation [m-ms1]			•
Ather intermedient			

Figure 206. Path 12088, parameters.

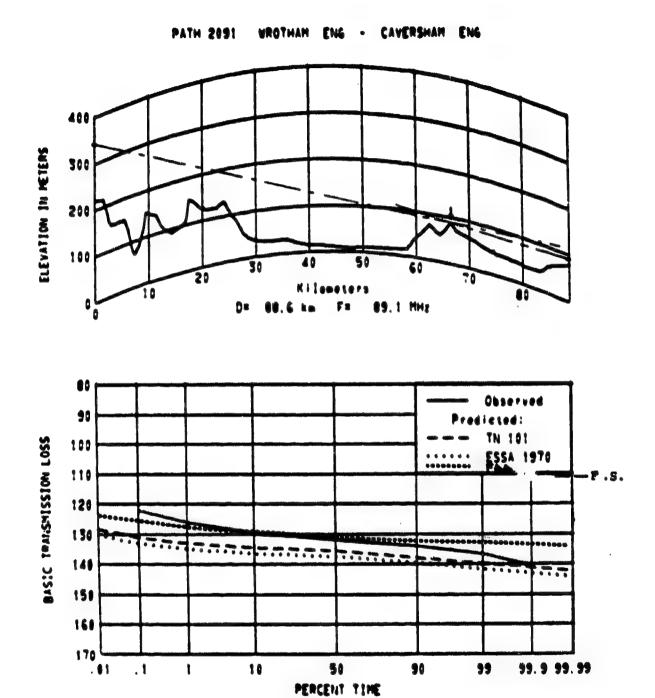


Figure 207. Path 12091, profile and predictions.

Path Number: Code Number: 1 1 2 0 2 1 0 Location: Wrotham, England - Co	4 5 2 1 1 aversham, Englan	3 1 1 1 d	w-nis 1
Data type 2598 hourly medians	, Distance	average ground	1 2181-11
N _s 318 N-units, a 8784 Climate maritime temperate overla	km, Surrace ty: nd	de	km
Frequency 89.1 MHz, Transmitte			dBW
Δh 112.9 m, θ mr.			-
Antenna elevation [m-ms1]	Transmitter 342.9	Receiver 91.4	
<pre>gain [dBi], main beam height [m], above site surface</pre>		13.7	
line loss [dB] polarization	Н	Н	
type Horizon distance [km]		21.89	
elevation [m-msl] elevation angle [deg]		88.4	
Location, latitude	51°19'11"N	51°28'52"N	
longitude Path bearing	0°17'20"E	0°57'23"W	
elevation [m-ms1]			

Figure 208. Path 12091, parameters.

PATH 2009 DUSSELDORF W GER - ALDEBURGH ENG

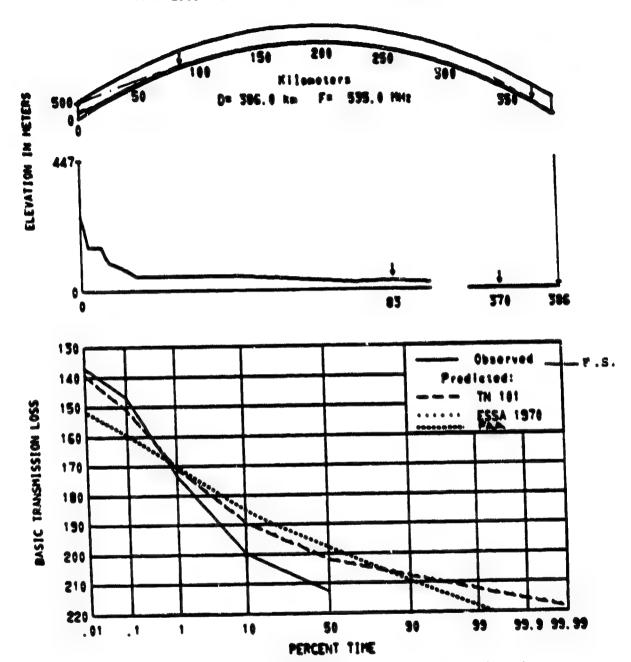


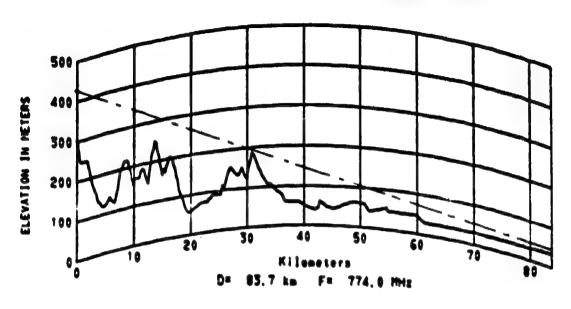
Figure 209. Path 12099, profile and predictions.

Path Number:	1 2 0 9	9	
Code Number: 1 1 2 5 3 0 0	9 4 5 3 1 1	3 4 1 1	
Location: Dusseldorf, West Ger	umany - Aldeburgh	England	
Data type 1500 hourly medians	_, Distance 386	5.0 km,h 0	m-ms 1
N 317 N-units, a 8766	km, Surface typ	se sea water	
Climate maritime temperate over	sea	de	km
Frequency 535 MHz, Transmit			dBW
Δh <u>0</u> m, θ mr.			-
	Transmitter	Receiver	
Antenna elevation [m-ms1]	447.1	14.0	
gain [dBi], main beam			
height [m], above site surface		13.7	
line toss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude	51°20'N	52°08'50"N	
longitude	7°02'E	1°36'15"E	
Path bearing			
elevation [m-msl]			
Other information:			

OT/TRER 16, &ig. 3.138

Figure 210. Path 12099, parameters.





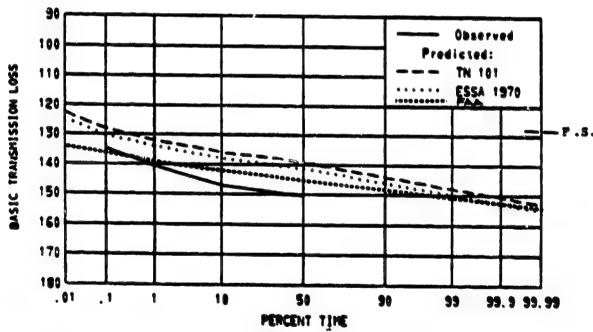
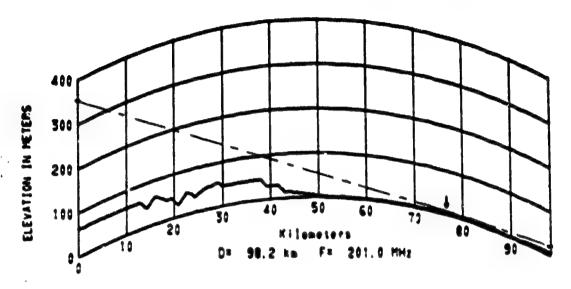


Figure 211. Path 12100, profile and predictions.

Path Number: Code Number: 1 1 2 7 1 0 0 Location: Pontop Pike, England Data type 6695 hourly medians N 312 N-units, a 8676 Climate maritime temperate overle	4 5 2 1 1 - Dishforth, Eng. , Distance 8: km, Surface type	3 1 1 1 gland 3.7 km, h _{rs} 33.8 be average ground	
Frequency 774 MHz, Transmitte			
$\Delta h = 100.4 m, \theta = mr.$			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	427.3	46.0	
gain [dBi], main beam			
height [m], above site surface		12.2	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		52.6	
elevation [m-msl]		183.	
elevation angle (deg)		**************************************	
Location, latitude	54°52'08"N	54°08'43"N	
longitude	1º46'11"W	1°25'25"W	
Path bearing			
elevation [m-ms1]		en allemente de la company	
Other information:			

Figure 212. Path 12100, parameters.





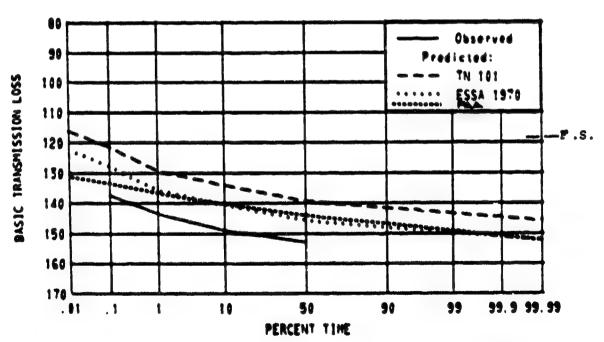


Figure 213. Path 12107, profile and predictions.

	1 2 1 0	7	
Path Number:	4 5 2 1 1 Potarborough E	3 1 1 1 notand	
Location: Mendlesham, England	or reaction ways,	2 km h 7.9	m-ms1
Data type 1 year of hourly medians	, Distance //	cuanage anound	-
N 320 N-units, a 8822	km, Surtace typ	do do de	km
manitimo temperate overta	na	GC	dBW
Frequency 201 MHz, Transmitt	er output	asw, EIKP	
Δh 32.9 m, θ mr.			
	Transmitter	Receiver	
a superior (mems)	353.9	20.1	
Antenna elevation [m-ms1].			
gain (dBi), main beam		12.2	
height [m], above site surface			
line loss [dB]	Н	Н	
polarization			
type		21.55	
Horizon distance [km]		1.6	
elevation [m-ms1]			
elevation angle (deg)		52°34'17"N	
Location, latitude	52°14'03"N	0°13'21"W	,
langitude	1°06'32"E	0-15-71-0	•
Path bearing			
elevation [m-msl]		der de de la companya del companya del companya de la companya de	•
Other information:			

Figure 214. Path 12107, parameters.



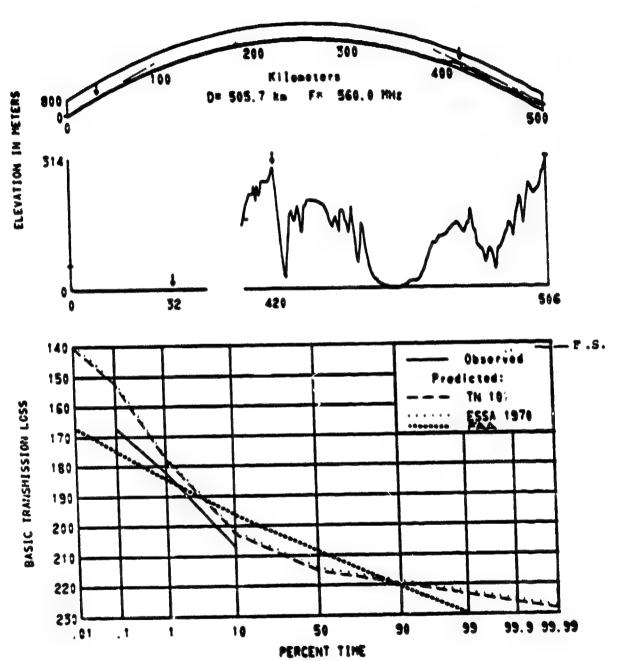
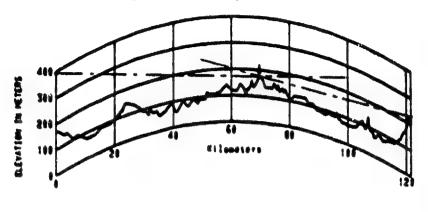


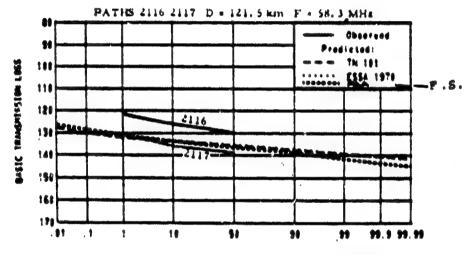
Figure 215. Path 12115, profile and predictions.

Path Number: Code Number: 1 1 2 5 3 0 0 Location: Scheveningen, Netherl 13 months of Data type hourly medians N. 312 N-units, a 8676	. Distance 505 km, Surface typ	e sea water	
Climate maritime temperate oversed			
Frequency 560 MHz, Transmitte	er output	OOW, EIRI	
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface line loss [dB] polarization type Horizon distance [km] elevation [m-ms1]	<u>Transmitter</u> <u>59.1</u> <u>45.7</u> <u>H</u>	Receiver 313.9 H	•
elevation (m-ms); elevation angle [deg] Location, latitude longitude Path bearing elevation [m-ms]	52°06'N 4°16'E	54°52'08"N 1°46'11"W	1 Mills

Figure 216. Path 12115, parameters.

SUTTON COLDFIELD ENG - GREEN HAILEY ENG PATHS 2116 TO 2119, 2121 2122 2124





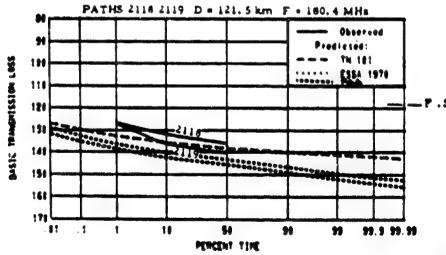


Figure 217. Paths 12116 through 12119, profile and predictions.

Path Number: Code Number: 1 1 2 0 2 2 0 Location: Sutton Coldfield, Eng Data type 640 hourly medians N 315 N-units, a 8729	4 5 2 1 1 land - Green Hai , Distance 12 km, Surface typ	1.5 km,h, 100	m-ms 1
Climate maritime temperate overla	ana	ARW FIRP	dBW
Frequency 58.2 MHz, Transmitt	er output		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	394.1	249.9	
gain [dBi], main beam			
height [m], above site surface	Laurenter retariations and Milde Water Milder Street, or other	22.8	
line loss [dB]			
polarization	Н	. Н	
type		51.95	
Horizon distance [km]		175.3	
elevation [m-msl]		1/3.3	•
elevation angle (deg)			
Location, latitude	52° 35' 59"N	51°43'10"N	•
long i t ude	1°49'57"W	0°47'06"W	•
Path bearing			20
elevation [m-ms1]		The same and the second second second second second second second second second	**
Other information:			

Figure 218. Path 12116, parameters.

Path Number:	1 2 1 1	7	
Code Number: 1 1 2 0 2 2 0	4 5 2 1 1	3 1 1 1	
Location: Sutton Coldfield, En			1
Data type 6373 hourly medians			m-ms l
N 315 N-units, a 8729	km, Surface typ	e average ground	
Climate maritime temperate overla	nd	de	km
Frequency 58.2 MHz, Transmitt	er output	dBW, EIRP	dBW
$\Delta h = -\frac{72}{m}, \; \theta = -\frac{mr}{r}.$			
Antenna elevation [m-msl]	Transmitter 394.1	Receiver 230.1	
gain [dBi], main beam			
height [m], above site surface		3	
line loss [dB]		4	
polarization	Н	Н	
type			
Horizon distance [km]		51.95	
elevation [m-msl]		175.3	
elevation angle [deg]			
Location, latitude	52° 35' 59"N	51°43'10"N	
longitude	1°49'57"W	0°47°06"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 219. Path 12117, parameters.

Path Number: Code Number: 1 1 2 1 2 2 0 Location: Sutton Coldfield, Eng Data type 3274 hourly medians N. 315 N-units, a 8729	4 5 2 1 1 gland - Green Hai , Distance 121.	3 1 1 1 Ley, England 5 km,h 100	m=ms 1
Climate maritime temperate overla	nd	de	km
Frequency 180.4 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 72 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	380.1	230.1	
gain [dBl], main beam			
height [m], above site surface		3	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		51.95	
elevation [m-ms1]		175.3	
elevation angle (deg)			
Location, latitude	52°35'59"N	51°43'10"N	
longitude	1°49'57"W	0°47'06"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 220. Path 12118, parameters.

Path Number:	1 211	9	
Code Number: 1 1 2 1 2 2 0			
Location: Sutton Coldfield, En	ıgland - Green Hai	ley, England	
Data type 3117 hourly medians	, Distance 121	.5 km, h 100	m-ms1
N 315 N-units a 8729	km, Surface typ	e average ground	
Climate maritime temperate overlar	nd	de	km
Frequency 180.4 MHz, Transmit			dew
Δh 72 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	350.2	230.1	
gain [dBi], main beam			
height [m], above site surface		3	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance (km)		51.95	
elevation [m-msi]		175.3	
elevation angle [deg]			
Location, latitude	52° 35' 59"N	51° 43' 10"N	
longitude	1°49'57"W	0°47'06"W	
Path bearing			
elevation [m-ms1]			
Other Information:			

Figure 221. Path 12119, parameters.

SUTTON COLDFIELD ENG - GREEN HAILEY ENG

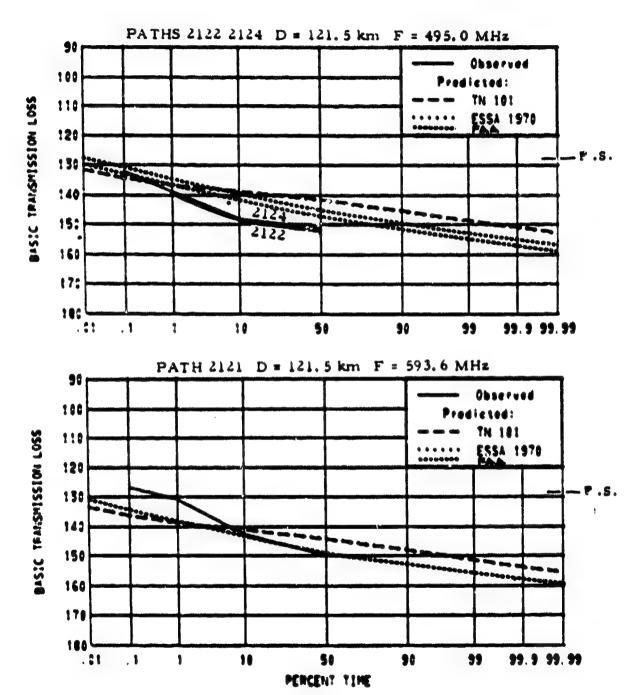


Figure 222. Paths 12122, 12124, and 12121, predictions. (see Figure 217 for profile)

Path Number:	_ 1 2 1 2	2	
Code Number: 1 1 2 4 2 2	0 4 5 2 1 1	3111	
Location: Sutton Coldfield,			
Data type 2868 hourly median	18 . Distance 121	.5 km, h 100	m-ms1
N ₂ 315 N-units, a	8729 km, Surface typ	e average ground	
Climate maritime temperate over			km
Frequency 495 MHz, Transm	itter output	dBW, EIRP	dBW
Δh 72 m, θ m	r.		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	350.2	232.	
gain [dBi], main beam			
height [m], above site surface		4.9	
line loss [dB]			
polarization	Н	<u> </u>	
type			
Horizon distance [km]		51.95	
elevation [m-msl]		175.3	
elevation angle [deg]			
Location, latitude	52° 35' 59"N	51°43'10"N	
longitude	1049'57"W	0°47'06"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 223. Path 12122, parameters.

Data type 1534 hourly medians N _S 315 N-units, a 8729	km, Surface typ	e_average_ground	m-ms 1
Climate maritime temperate overlan Frequency 495 MHz, Transmitt	er output	dBW, EIRP	BW
$\frac{72}{m}$, $\frac{9}{m}$, $\frac{9}{m}$			
Continue de la contin	Transmitter	Receiver	
Antenna elevation [m-ms1]	380.1	232.0	
gain [dBi], main beam			
height [m], above site surface		4.9	
line loss [dB]			
polarization	Н	Н	
type		£1 0L	
Horizon distance [km]		51,95	
elevation [m-ms]]		175.3	
elevation angle [deg]	52° 35' 59"N	51°43°10"N	
Location, latitude			
longitude	1°49'57"W	0°47'06"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 224. Path 12124, parameters.

Path Number:	_1 2 1 2	1	
Code Number: 1 1 2 5 2 2 0	4 5 2 1 1	3 1 1 1	
Location: Sutton Coldfield, En	gland - Green Hai	ley, England	
Data type 511 hourly medians	, Distance 121	.5 km, h 100	m-ms l
N _s 315 N-units, a 8729			
Climate maritime temperate overla	nd		km
Frequency 593.6 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 72 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	350.2	249.9	
gain [dBi], main beam			
height [m], above site surface		22.8	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]	·	51.95	
elevation [m-msl]		175.3	
elevation angle [deg]			
Location, latitude	52° 35' 59"N	51°43'10"N	
long i tude	1 ⁰ 49'57"W	0°47'06"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 225. Path 12121, parameters.

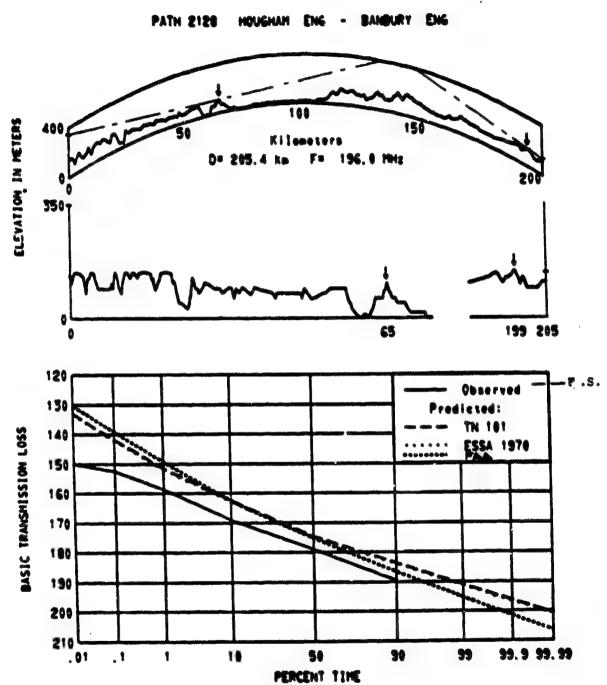
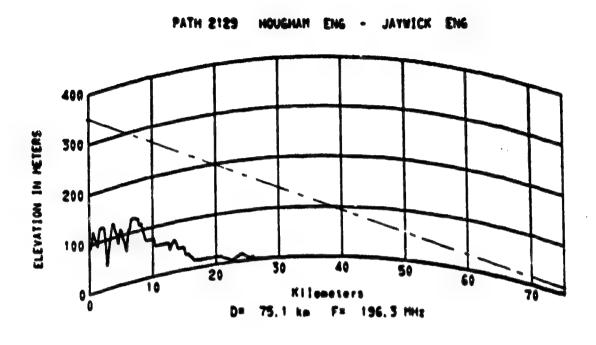


Figure 226. Path 12128, profile and predictions.

Path Number:			
Code Number: 1 1 2 1 3 0 0	4 5 2 1 1	3111	
Location: Hougham, England - Bo	anbury, England		
Data type 2100 hourly medians	_, Distance 205	.4 km, h _{rs} 106.7	m-ms l
N _s 317 N-units, a 8766	km, Surface typ	e average ground	-
Climate maritime temperate overli	and	de	km
Frequency 196 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 127.2 m, θ mr.			
•	Transmitter	Receiver	
Antenna elevation [m-ms1]	349.9	139.9	
gain [dBi], main beam			
height [m], above site surface		29.5	
line loss [dB]			
polarization	V	<u> </u>	
type			
Horizon distance [km]		6.44	
elevation [m-msl]		144.8	
elevation angle [deg]			
Location, latitude	51°06'40"N	52°02'05"N	
longitude	1°14'58"E	1°18'50"	
Path bearing			
elevation [m-msl]			
0.1 - 1-6			

Figure 227. Path 12128, parameters.



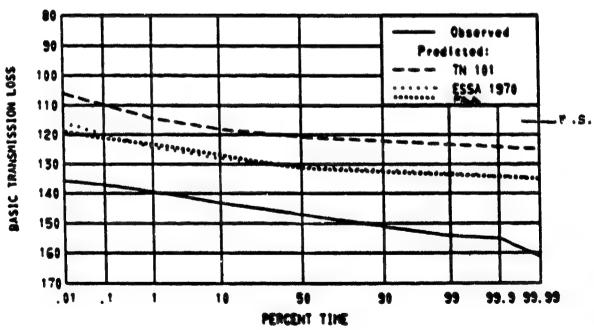


Figure 228. Path 12129, profile and predictions.

Path Number:	1 2 1 2	9	
Code Number: 1 1 2 1 1 0 0	4 5 1 1 1	3111	
Location: Hougham, England -			
Data type 2100 hourly medians			m-ms1
N 315 N-units, a 8729	km, Surface typ	e sea water	· · · · · · · · · · · · · · · · · · ·
Climate maritime temperate overs			km
Frequency 196.2 MHz, Transmitter output		dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms]]	349.9	14.9	ı
gain (dBi), main beam			,
height [m], above site surface		9.1	
line loss [dB]			
polarization	Н	Н	,
type			•
Horizon distance [km]			
elevation [m-ms1]			•
elevation angle [deg]			•
Location, latitude	51°06'40"N	51°46'50"N	
longitude	1º14'58"E	1°07'20"E	•
Path bearing			
elevation [m-msl]			•
Other information:			

Figure 229. Path 12129, parameters.



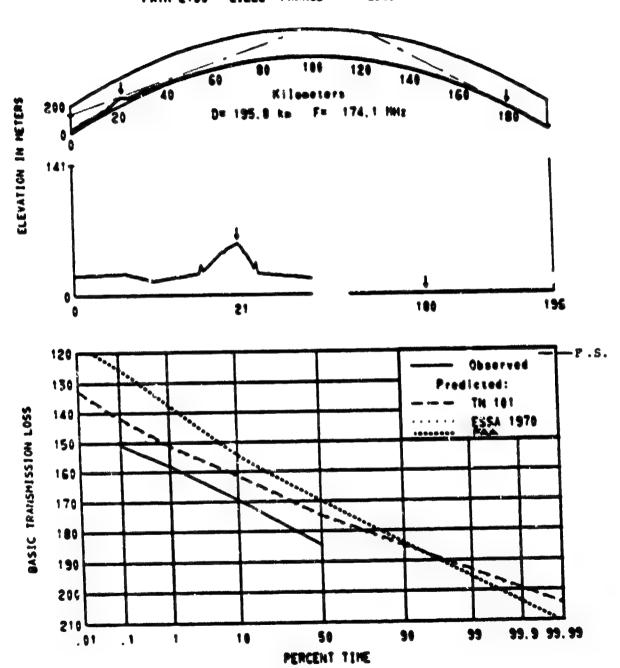


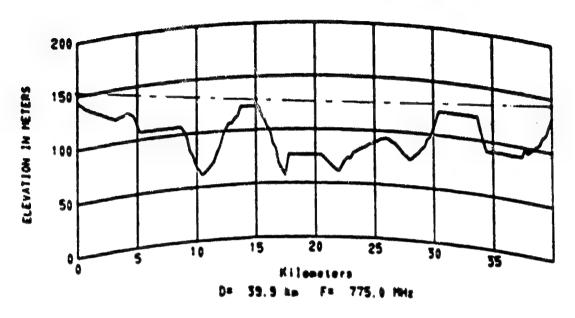
Figure 230. Path 12133, profile and predictions.

Path Number: Code Number: 1 1 2 1 3 0 0 Location: Lille, France - Aldeb Data type 8 months of hourly medians N 320 N-units, a 8822	urgh, England Distance 195. km, Surface type	3 4 1 1 8 km.h _{rs} 0 e sea water	
Climate maritime temperate overse	a .	401 5100	dBW
Frequency 174.1 MHz, Transmitte	er output	GBW, EIRP	
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	141.1	14.9	
gain [dBi], main beam			
height [m], above site surface		14.6	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			-
Location, latitude	50° 38' 30"N	52°08'50"N	-
longitude	3°03'30"E	1°36'15"E	-
Path bearing			-
elevation [m-ms1]			
Other information:			

OT/TR"? 16, 6ig. 3.133

Figure 231. Path 12133, parameters.





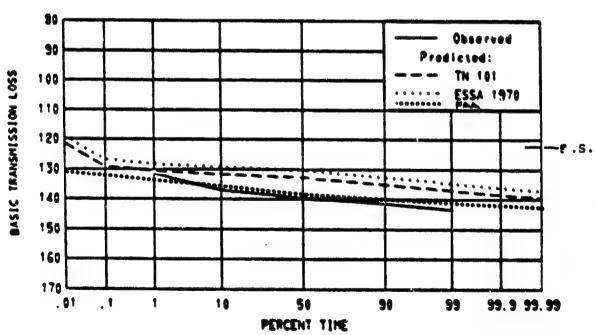
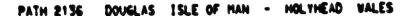
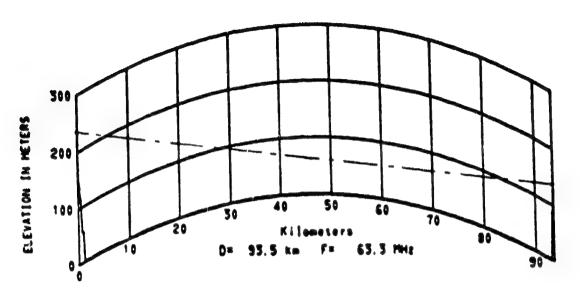


Figure 232. Path 12134, profile and predictions.

Path Number:	1 2 1 3	4	
Code Number: 1 1 2 7 1 0	0 4 5 2 1 1	3111	
Location: Throcking, England	i - Stanmore, Englan	d.	
9976 hourfu media	r∆ Distance 39	.9 km,h	m-ms 1
N 316 N-units, a 87	17 km, Surface typ	e average ground	
Climate maritime temperate ove	rland	de	km
Frequency 775 MHz, Transm	itter output	dBW, EIRP	dBW
Δh_ 87.8 m, θ m			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	153	143.9	
gain [d8i], main beam			
height [m], above site surface		12.2	
line loss (dB)			
	н	H	
polarization			
type		24.8	
Horizon distance [km]		122.	•
elevation [m-ms1]			•
elevation angle [deg]	51°57'03"N	51°37'51"N	•
Location, latitude	0°03'34"W	0°19'15"W	•
longitude	0°03°54"W	0 17 17 0	•
Path bearing			•
elevation [m-msl]			-
Other information:			

Figure 233. Path 12134, parameters.





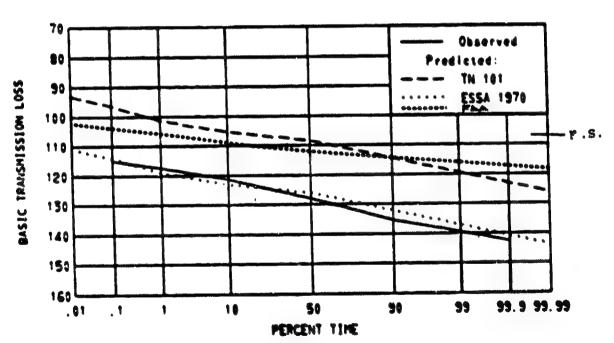
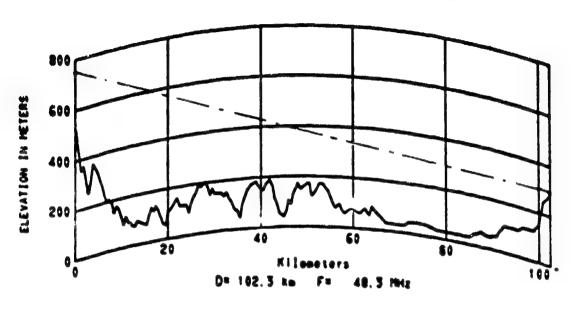


Figure 234. Path 12136, profile and predictions.

Path Number:	_ 1 2 1 3	6	
Code Number: 1 1 2 0 1 0 0	4 5 3 1 1	3111	
Location: Douglas, Isle of Man	- Holyhead, Wale	.	
Data type 3000 hourly medians	_, Distance <u>93.</u>	5 km, hrs 0	m-ms l
N 319 N-units, a 8803	_km, Surface typ	e sea water	
Climate maritime temperate overse	ea .	de	km
Frequency 63.2 MHz, Transmitte	er output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	235	137.2	
gain [dBi], main beam			
height [m], above site surface		9.2	•
line loss (dB)			
polarization	V	V	•
type			•
Horizon distance [km]		93.5	•
elevation [m-ms1]			-
elevation angle (deg)			-
Location, latitude	54°08'25"N	53°18'33"N	-
longitude	4°29'32"W	404111346	-
Path bearing			-
elevation [m-msl]			-
and the second second			

Figure 235. Path 12136, parameters.





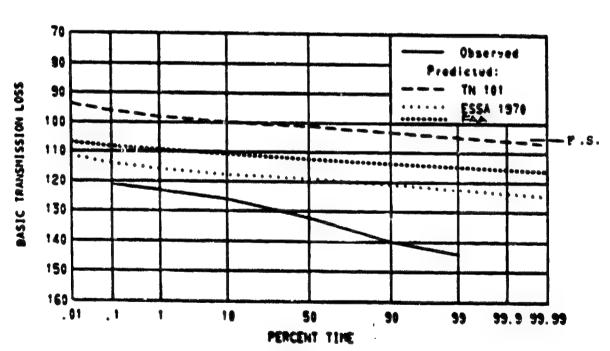
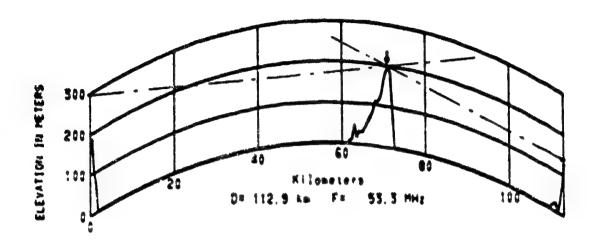


Figure 236. Path 12137, profile and predictions.

Path Number: Code Number: 1 1 2 0 1 0 0 Location: Holme Moss, England Data type 2100 hourly medians N. 303 N-units, a \$525	10 4 5 2 1 1 - Arncliffe Wood, 	3 1 1 1 England .3 km, h _{rs} 190	m-ms l
N _s 303 N-units, a 8525 Climate maritime temperate overla	with your condition type	de	km
Frequency 48.2 MHz, Transmit	ter output	dBW. EIRP	dRW
Δh 153 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	740.9	296	
gain [dBi], main beam			
height [m], above site surface		6.1	
line loss [dB]			
polarization	Н	Н	
type			•
Horizon distance [km]		102.3	•
elevation [m-ms1]		524.3	•
elevation angle [deg]			•
Location, latitude	53°31'58"N	54° 23' 20"N	•
tong! tude	1051.2240	1º 17 · 30 · w	٨
Path bearing			-
elevation [m-ms1]		quinting distributions and the state of the	-
Other information:			

Figure 237. Path 12137, parameters.

PATH 2148 BLAEN PLWYF WALES - HOLYHEAD WALES



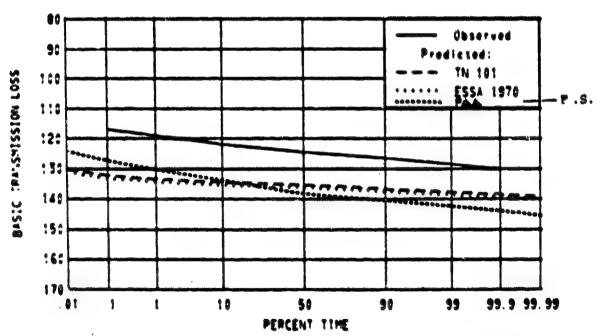
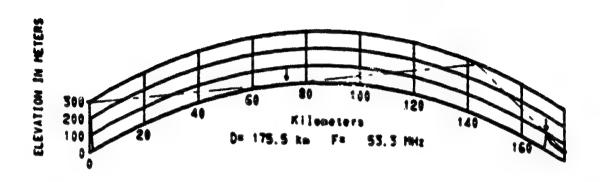


Figure 238. Path 12140, profile and predictions.

Path Number:	4 5 3 1 1	3 1 1 1	
Location: Black Plwy6, Wales -	Holyhcad, Wales		
Data type 3000 howrly medians	_, Distance112	.9 km, h _{rs}	m-ms 1
N ₂ 316 N-units, a 8747	km, Surface typ	e sea water	
Climate maritime temperate overse	<u>a</u>	de	km
Frequency 53.2 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	298.1	137.2	
gain [dBi], main beam			
height [m], above site surface	the same of the sa	9.2	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		42.04	
elevation [m-ms1]		198.1	
elevation angle [deg]			
Location, latitude	52°21'36"N	53°18'33"N	
longitude	4° 06 ° 00"W	4°41'13"W	
Path bearing			•
elevation [m-ms]]			,
Other information:			

Figure 239. Path 12140, parameters.

PATH 2141 BLAEN PLAYF WALES - DUBLIN IRE



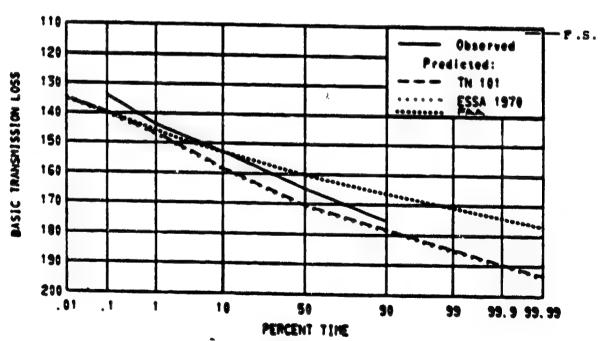
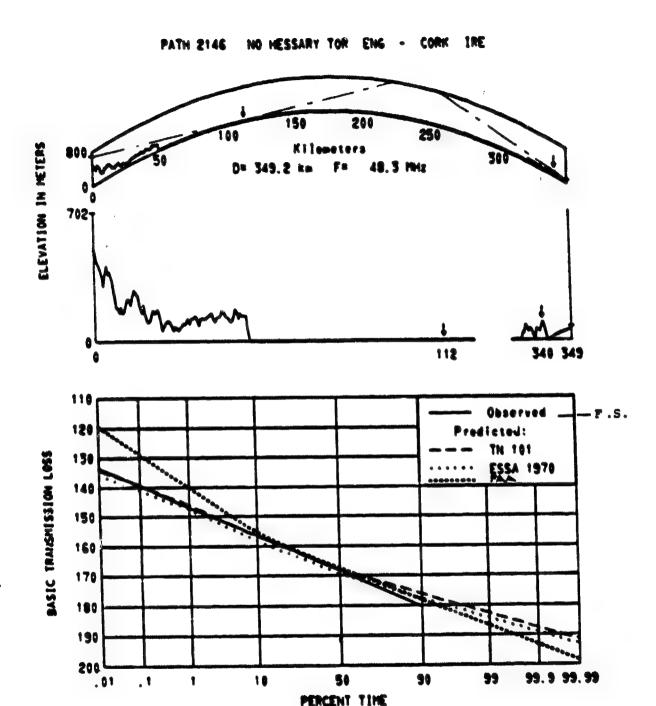


Figure 240. Path 12141, profile and predictions.

Path Number: Code Number: 1 1 2 0 3 0 0 Location: Blaen Plwys, Wales - Data type 4200 hourly medians	4 5 2 1 1 Dublin, Treland , Distance 175	3 1 1 1 5.5 km, h _{rs} 0	m-ms 1
N 321 N-units, a 8841	_km, Surface typ	e average ground	
Climate maritime temperate overlan			
Frequency 53.2 MHz, Transmitte Ah 6.7 m, 0 mr.	er output	OBW, EIRP	
	Transmitter	Receiver	
	298.1	54.9	
gain [dBi], main beam height [m], above site surface		9.2	
line loss [dB]			
polarization	н		
type			
Horlzon distance [km]		6.44	
elevation [m=msl]		91.4	,
elevation angle [deg]			•
Location, latitude	52°21'36"N	53°17'34"N	•
long itude	4º06'00"W	6011'49"	
Path bearing			•
elevation [m-ms]]			•
Other information:			

Figure 241. Path 12141, parameters.



PERCENT TIME Figure 242. Path 12146, profile and predictions.

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Path Number: Code Number: 1 1 2 0 3 0 0 Location: No. Hessary Tor, Eng Data type 4200 hourly medians	4 5 2 1 1 land - Cork, Irel , Distance 349.	3 1 1 1 land .2 km,h _{rs} 0	m-ms 1
N _s 322 N-units, a 8860			
Climate maritime temperate overlan			km
Frequency 48.2 MHz, Transmitt	er output	dBW, EIRP	- daw
Δh 130.7 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	702	72.8	
gain [dBi], main beam			
height [m], above site surface		12.1	
line loss [dB].			
polarization	Н	Н	
type			
Horizon distance [km]		9.17	
elevation [m-ms1]		97.5	
elevation angle [deg]			
Location, latitude	50° 32' 59"N	51°55'40"N	
longitude	4°00'26"W	8°29'50"W	
Path bearing			
elevation [m-msl]		ئەكتىكىنىدىنىدىنىدىدىدىدىدىدىدىدىدىدىدىدىدىد	
Othur Informations			

Figure 243. Path 12146, parameters.



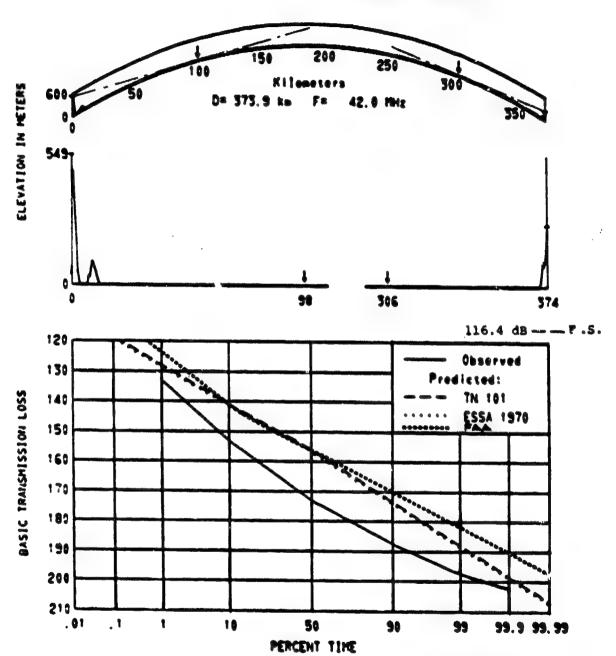


Figure 244. Path 12148, profile and predictions.

Path Number:	_ 1 2 1 4	8	
Code Number: 1 1 2 0 3 0 0			
Location: Bergen, Norway - Scot			
Data type 16000 hourly medians	_, Distance <u>373</u>	.9 km, h	m-ms 1
H ₂ 318 N-units, a 8784	km, Surface typ	e sea water	
Climate maritime temperate overse			km
Frequency 42 MHz, Transmit/t	er output	dBW, EIRP	dBW
$\Delta h = 0$ in, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	548.9	262.1	
gain [dBi], main beam			
height [m], above site surface		17.3	
line loss [dB]			
polarization	н	н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deq]			
Location, latitude	60° 24' 42"N	59°57'10"N	
longitude	5°21'50"E	1°18'20"W	
Path bearing			
elevation [m+ms1]			
Other information:	•		

Figure 245. Path 12148, parameters.

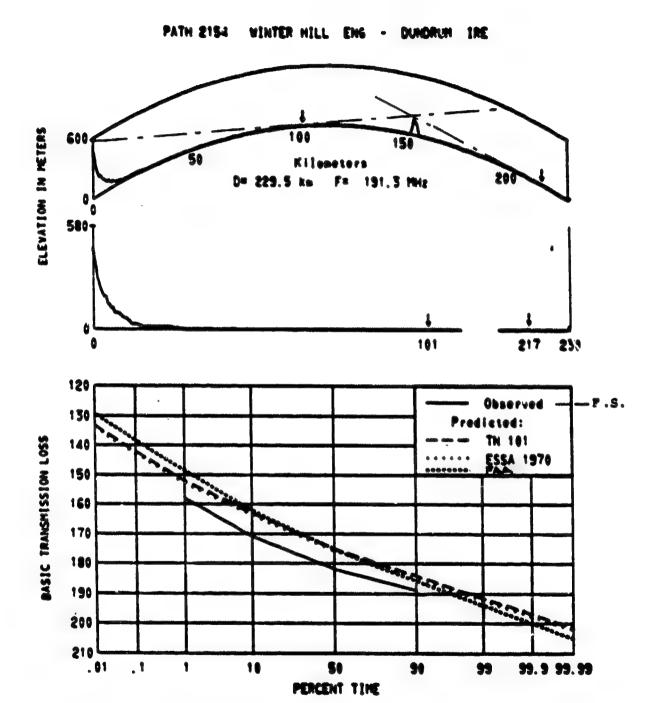
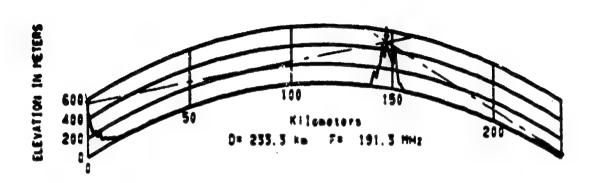


Figure 246. Path 12154, profile and predictions.

Path Number:	1 2 1 5	4	
Code Number: 1 1 2 1 3 0			
Location: Winter Hill, Englar	id - Dundrum, Irela	ınd	
Data type 4200 hourly medians	, Distance 229).5 km,h 0	m-ms l
N 321 N-units, a 8841			
Climate maritime temperate over	land	de	km
Frequency 191.2 MHz, Transmi			
Δh 36.4 m, θ mr			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	580	17	
gain (dBi), main beam			
height [m], above site surface		9.1	
line loss [dB]			
polarization	v	V	
type			
Horizon distance [km]		12.39	
elevation [m-msl]		6.1	
elevation angle [deg]			
Location, latitude	53° 37' 44"N	54° 15' 31"N	
longitude	20 30 · 55 MW	5050126 MW	
Path bearing			
elevation [m-msl]			
Other Information.			

Figure 247. Path 12154, parameters.



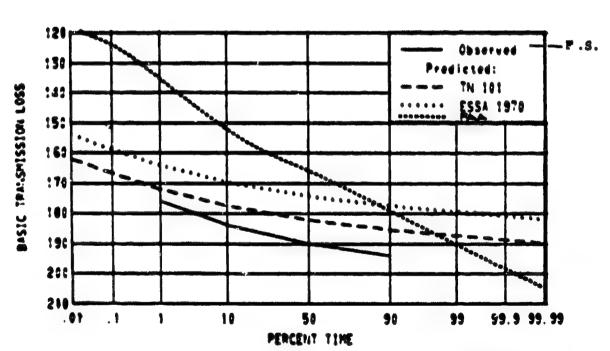


Figure 248. Path 12155, profile and predictions.

Path Number:	1 2 1 5	<u>5</u>	
Code Number: 1 1 2 1 2 2 0	1 4 5 3 1 1	3 1 1 1	
Location: Winter Hill, England	l - Newtownards,	ireland	
Data type hourly medians	. Distance 23	3.3 km 5 C	m-ms 1
N 315 N-units a 8694	km Surface tu	sea water	(1) (1)
Climate maritime temperate over			km
Frequency 191.2 MHz, Transmitt			
Δh 0 m, θ mr.	ter output	GDM, SIKP	dBW
an v m, 9 mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	579.1	39.6	
gain [dBi], main beam			
height [m], above site surface		9.1	
line loss [dB]			
polarization	· V	V	
type			
Horizon distance [km]	Affic and the second of the se	86.21	
elevation [m-ms1]		472.4	
elevation angle [deg]		,	
Location, latitude	55° 37' 44"N	54°55'19"N	
longitude	2°30'55"W	5°41' W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 249. Path 12155, parameters.

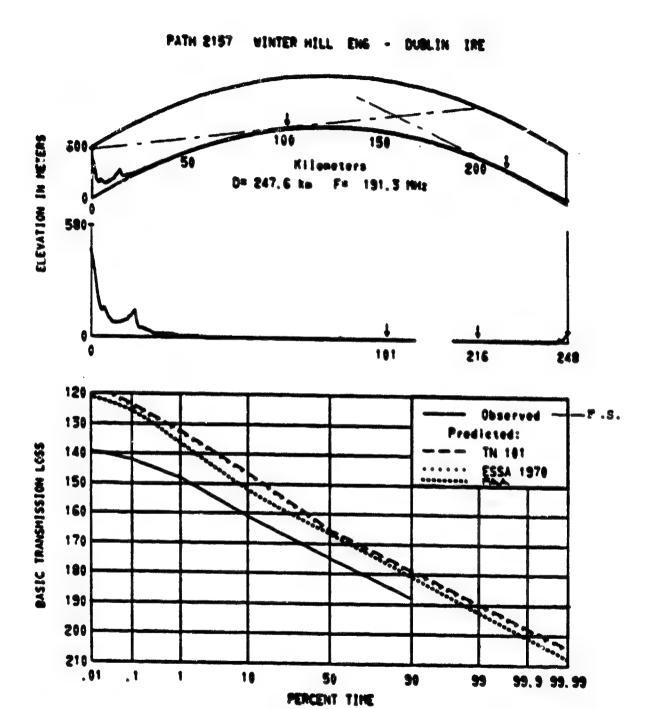
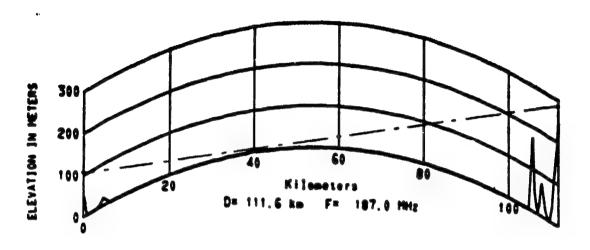


Figure 250. Path 12157, profile and predictions.

Path Number:	_1 215	1	
Code Number: 1 1 2 1 3 0 0			
Location: Winter Hill, England	- Dublin, Irelan	d	
Data type 4200 hourly medians			m-ms l
N 322 N-units, a 6860	km, Surface typ	e sea water	
Climate maritime temperate overses	1	de	km
Frequency 191,2 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh <u> q</u> m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	580	54.9	,
gain [dBi], main beam			
height [m], above site surface		9,2	
line loss [dB]			•
polarization	н	н	•
type			-
Horizon distance [km]			-
elevation [m-mil]			•
elevation angle [deg]			.
Location, latitude	53° 37' 44"N	53 ⁰ 17'34"N	
longitude	2°30'55"W	6°11'49"W	
Path bearing			-
elevation [m-msl]			-
Othersinformations			

Figure 251. Path 12157, parameters.

SANDAY ORKNEY IS - SCOUSBURGH SHETLAND IS PATHS 2168 2169



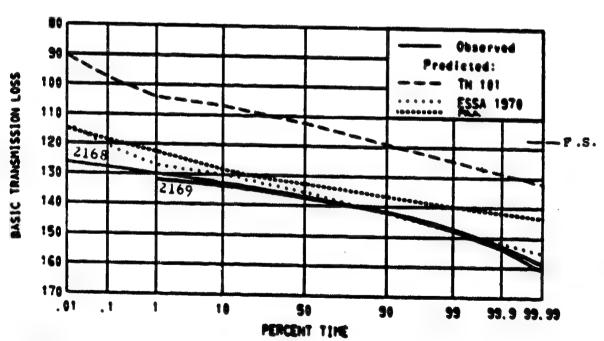


Figure 252. Paths 12168 and 12169, profile and predictions.

Path Number:	1 2 1 6	8	
Code Number: 1 1 2 1 1 0 0	4 5 3 1 1	3 5 1 1	
Location: Sanday, Orkney Island	ds - Scousburgh,	Shetland Islands	
Data type 8400 hourly medians	_, Distance <u>111</u> .	6 km, h	m-ms 1
N _s 315 N-units, a 8729	km, Surface typ	e sea water	,
Climate maritime temperate overs	ea	de	km
Frequency 187 MHz, Transmitt	er output	dBW, EIRP	dBW
$\Delta h = 0 m_* \theta mr_*$			
	Transmitter	Receiver	
Antenna elevation [m-msl]	107.9	285.9	
gain [dBi], main beam			
height [m], above site surface	57.9		•
line loss [dB]			
polarization	н	Н	•
type			
Horizon distance [km]			
elevation [m-msl]			_
elevation angle [deg]			
Location, latitude	59 ⁰ 13'16"N	59 ⁰ 57'10 ^H N	
longitude	2 ⁰ 39'06"W	10 18' 20"W	
Path bearing			
elevation [m-msl]			-
Other information:			-

Figure 253. Path 12168, parameters.

	Path Number:	1 2 1 6	9	
Code Number: 1	121100	4 5 3 1 1	3 5 1 1	
Location: Sa	anday, Orkney Islan	ds - Scousburgh,	Shetland Islands	
Data type84	100 hourly medians	, Distance <u>11</u>	1.6 km, h 0	m-ms1
N ₂ 315	_N-units, a8729	km, Surface typ	e sea water	
Climate maritim	ne temperate overse	a	de	km
Frequency 187	MHz, Transmitt	ter output	dBW, EIRP	dBW
Δh <u>0</u> m	. θmr.			
		Transmitter	Receiver	
Antenna elevation	n [m-ms1]	107.9	277.1	
gain [dBi], ma	in beam			
height [m], abo	ove site surface	57.9		
line loss [dB]				
polarization		Н	Н	
type				
<u>Horizon</u> distance	(km)			
elevation (m-m	is I }			
elevation angle	e [deg]			
Location, latitu	de	59 ⁰ 13'16"N	59°57'10"N	
longitude		2° 39' 06"W	1°18'20"W	
Path bearing				
elevation [m-m	is []			
Other information				

Figure 254. Path 12169, parameters.

PATHS 2174 2187 WROTHAM ENG - CASTLETON WALES

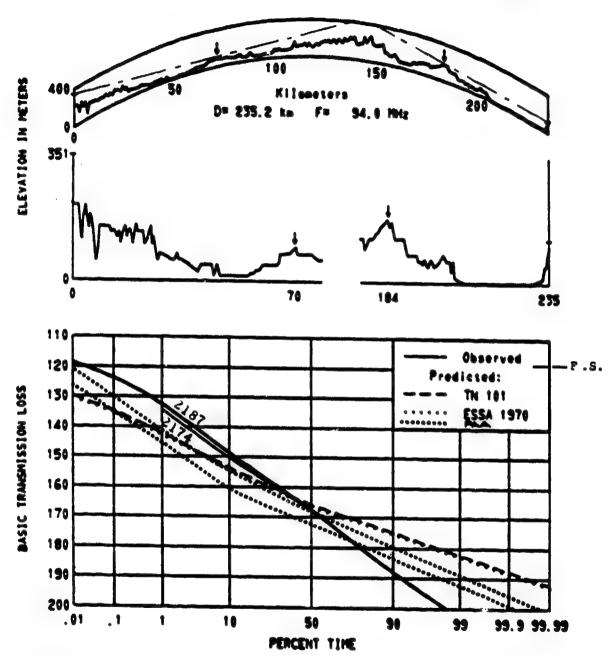


Figure 255. Paths 12174 and 12187, profile and predictions.

Path Number: Code Number: 1 1 2 0 3 0 0 Location: Wrotham, England - 3 Data type 4 months of howely media	2 4 5 2 1 1 Castleton, Wales	3 1 1 1 5.2 km.h 94.5	m-ins l
N-units 3 8/00	km. Surface tv	ne average akound	
Climete maritime temperate overla	und	de	km
Frequency 94. MHz, Transmit	ter output	dBW, EIRP	dBW
4h 170.4 m, e mr.			
	Transmitter	Receiver	
Antenna elevation [m-m51]	350.5	121.9	
gain (dBi), main beam			
height [m], above site surface		16.7	
line loss [dB]			
polarization	Н	н	
type			
Horizon distance [km]		51.34	
elevation [m-msl]		175.3	
elevation angle [deg]	(
Location, latitude	51 ⁰ 19'11"N	51° 33° 12"N	
long i t ude	0°17'20"E	3°04'14"W	
Path bearing			
elevation [m-ms]]			
Other Information			

Figure 256. Path 12174, parameters.

Path Number:	1 2 1 8	7	
Path Number:	7 4 5 2 1 1	3 1 1 1	
Location: Wrotham, England - (The Party of the P	entities window grappin carpains	
Data type 1200 hourly medians	. Distance 235.	2 km.h 94.5	m-ms.l
N. 317 N-units a 8766	km. Surface tvo	 average ground 	
Climate maritime temperate overlan	nd .	de	km
Frequency 93.8 MHz, Transmitt	ter output	dBW. EIRP	dBW
3h 170.4 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	349.9	107	
gain [dBi], main beam			
height [m], above site surface		1.8	
line loss [d8]			
polarization	Н	Н	
type			
Horizon distance [km]		51.34	
elevation [m-msl]		175.3	
elevation angle [deg]			
Location, latitude	51°19'11"N	51°33'12"N	
longitude	0°17'20"E	3°04'14"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 257. Path 12187, parameters.



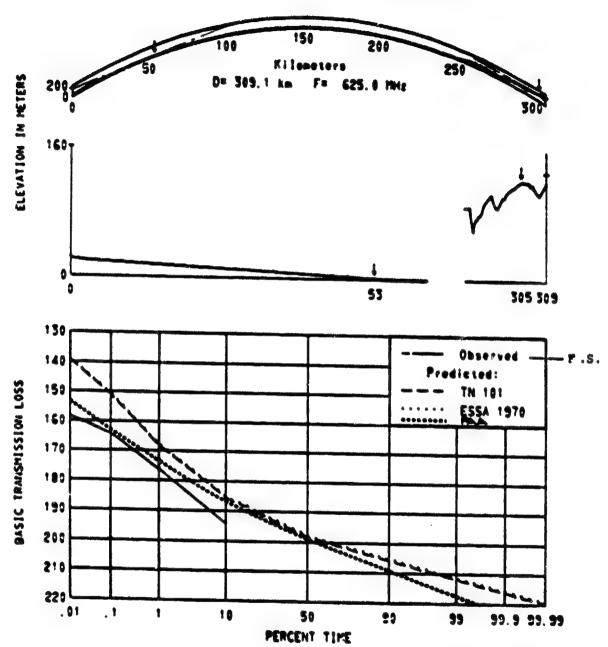


Figure 258. Fath 12175, profile and predictions.

Path Number:	1 2 1 7	_5	
Path Number:	4 5 2 1 1	3 4 1 1	
Location: Lopik, Netherlands -	Wickhambrook, En	gland	
Data type 6 months of hourly median	16, Distance 309.	1 km, h _{rs} 1	m-ms l
N _s 316 N-units, a 8747	km, Surface typ	e average ground	
Climate maritime temperate overla			km
Frequency 625 MHz, Transmitt			dBW
Δh 53.8 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	160	134.1	
gain [dBi], main beam			
height [m], above site surface		12.2	
line loss [dB]			
polarization	Н	<u> </u>	
type			
Horizon distance [km]		4.35	
elevation [m-ms1]		123.4	
elevation angle [deg]	and the second second second second		
Location, latitude	52°01'N	52 ⁰ 11'25"N	
longitude	5°03'E	0°33'01"E	
Path bearing			
elevation [m-ms1]		a districtive districtive descriptive in technologie when again (in. di. 2000) including and	
Other information:			

Figure 259. Path 12175, parameters.

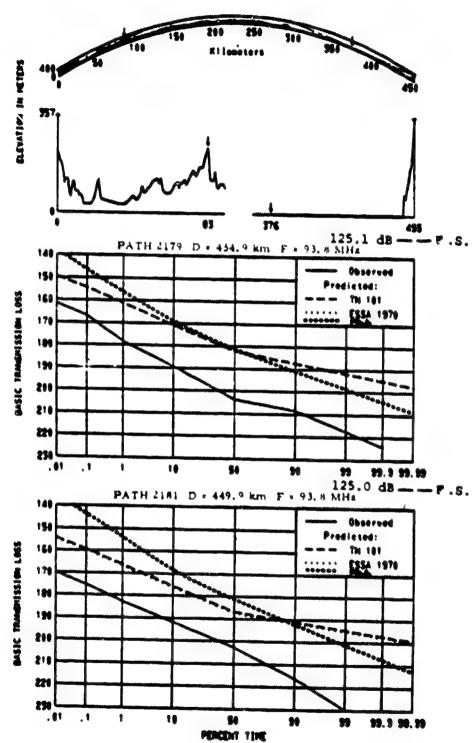


Figure 260. Paths 12179 and 12181, profile and predictions.

Path Number:	_1 111	9	
Code Number: 1 1 2 0 3 0 0	4 5 2 1 1	3 1 1 1	
Location: Wrotham, England - D	ouglas (high site) Isle of Man	
Data type 5500 hourly medians	, Distance 454	.9 km,h 0	m-ms l
N 317 N-units, a 8766	km, Surface typ	e average ground	
Climate maritime temperate overl	and	de	km
Frequency 93.8 MHz, Transmitt			dBW
Δh 103.4 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	350.5	356.6	
gain [dBi], main beam			
height [m], above site surface	131		
line loss [dB]			•
polarization	н	н	
type			
Morizon distance [km]	83.04		
elevation [m-msl]	237.7		
elevation angle (deg)			
Location, latitude	51 ⁰ 19111"N	54°12'50"N	
longitude	0°17'20"E	4°28'00"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 261. Path 12179, parameters.

Path Mumbur.		_	•
Location: Wrotham, England - Data type 2200 hourly medians N. 317. N-units 2 2764	Douglas (low site	3 1 1 1 1. Tale of Man 9.9 km, h _{rs} 0	m-ms)
crimate mucciome temperate overs	ea	de	km
Frequency 93.8 MHz, Transmi	tter output	daw, EIRP	dBW
Antenna elevation [m-ms] gain [dBi], main beam	Transmitter 350.5	Receiver 35.1	
height [m], above site surface line loss [dB]		9.2	
polarization type	Н	Н	
Horizon distance [km] elevation [m-msl] elevation angle [deg]			
Location, latitude longitude	51°19'11"N 0°17'20"E	54°10'35"N 4°25'15"W	•
Path bearing elevation [m-ms1] Other information:		- 25'15"W	

Figure 262. Path 12181, parameters.



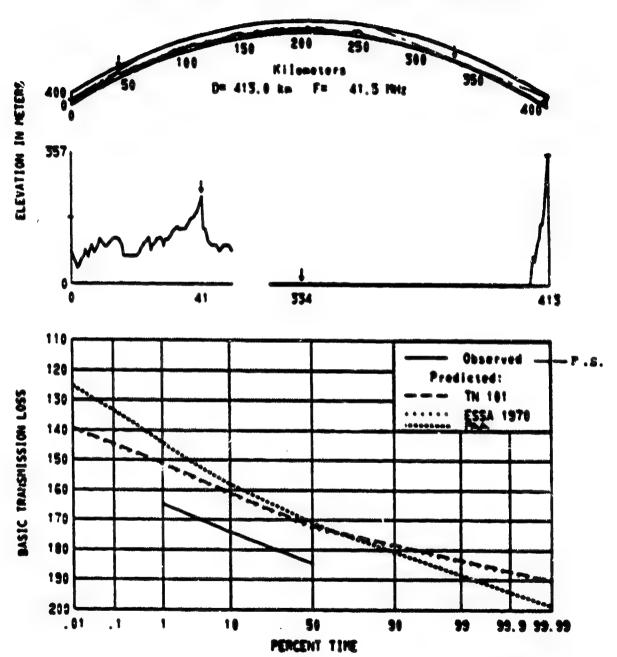


Figure 265. Path 12180, profile and predictions.

Path Number: Code Number: 1 1 2 0 3 0 Location: Alexandra Palace, El Data type 3600 hearly medians N _s 317 N-units, a 8760 Climate maritime temperate over	0 4 5 2 1 1 ngland - Douglas , Distance 413 6 km, Surface typ	3 1 1 1 high site) Isle of 3.0 km,h 0 e average ground	m-ms 1
Frequency 41.5 MHz, Transmit	ter output	day Find	km dBW
Δh 91.4 m, θ mr.			Q D W
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface line loss [dB] polarization type	182.9 91.5	<u>Receiver</u> 356.6	
Horizon distance [km]	41.2		
elevation [m-ms1]	239.3		
elevation angle [deg]			
Location, latitude	51° 55' 30"N	54°12'50"N	
long i t ud ≘	0°07'40"W	4º28'00"W	
Path bearing elevation [m-ms] Other information:			

Figure 264. Path 12180, parameters.



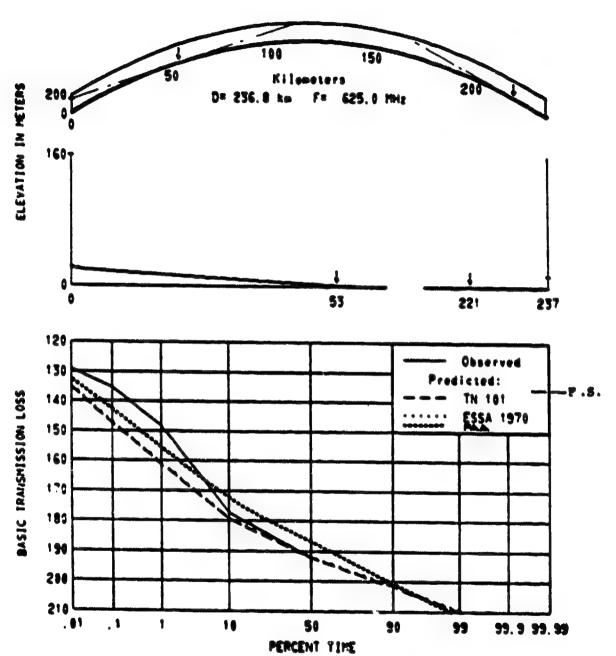


Figure 265. Path 12186, profile and predictions.

Path Number: Code Number: 1 1 2 6 3 0 Location: Lopik, Netherlands Data type 8000 hourly medians	0 4 5 3 1 1 - Aldeburgh, Engla , Distance 230	3 4 1 1 and 5.8 km, h 0	m-ms i
N _s 318 N-units, a 8784	km, Surface typ	e sea water	
Climate maritime temperate overs	ra .	de	km
Frequency 625 MHz, Transmitt	ter output	dBW, EIRP	dBW
δh 0 m, θ mr.			-
•	Transmitter	Receiver	
Antenna elevation [m-ms1]	160	14	
gain [dBi], main beam			
height [m], above site surface		13.7	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	52°01'N	52°08'50"N	
longitude	5°03'E	1°36'15"E	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 266. Path 12186, parameters.

PATH 2189 DORTHUND W GER - WICKHAMBROOK ENG

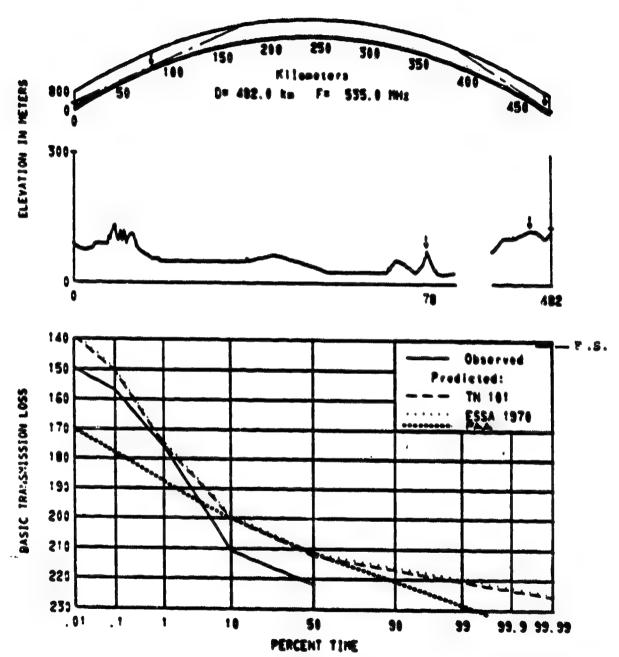


Figure 267. Path 12189, profile and predictions.

	1		
Code Number: 1 1 2 5 3 0			
Location: Dortmund, West Ger	unany - Wickhambrook	, England	
Data type 1900 hourly median			m-ms l
N _c 314 N-units, a 871	1 km. Surface typ	e average ground	
Climate maritime temperate over	iland	de	km
Frequency 535 MHz, Transmi	tter output	dBW, EIRP	d8W
3h 64.4 m, 0 mr			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	299.9	134.1	
gain [dBi], main beam			
height [m], above site surface		12.2	
line loss (dB)			
polarization	Н	Н	
type			
Horizon distance [km]		4.65	
elevation [m-msl]		125	
elevation angle [deg]			
Location, latitude	51°30'55"N	52 ⁰ 11'25"N	
longitude	7 ⁰ 27'24"E	0°33°01"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 268. Path 12189, parameters.

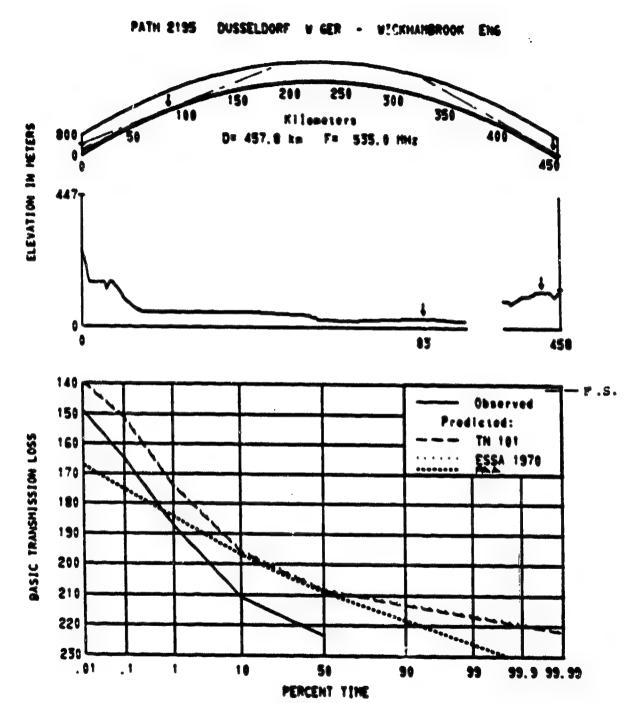


Figure 269. Path 12195, profile and predictions.

Path Number:	1 2 1 9	<u>5</u>	
Code Number: 1 1 2 5 3 0 0	4 5 2 1 1	3 4 1 1	
Location: Dusseldorf, West Ger			
Data type 1 year of hourly medians	5, Distance 45	7.8 km,h 30	m-ms 1
N ₂ 315 N-units, a 8729	km, Surface ty	pe average ground	
Climate maritime temperate overl	and	de	km
Frequency 535 MHz, Transmitt	ter output	dBW, EIRP	dBW
Δh 67.8 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	447.1	134.1	
gain [dBi], main beam			
height [m], above site surface		12.2	
line loss [dB]			
polarization	H	Н	
type			
Morizon distance [km]		4.5	
elevation [m-msl]		125.3	
elevation angle [deg]			
Location, latitude	51°20'N	52°11'25"N	
longitude	7°02'E	0°33'01"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 270. Path 12195, parameters.

PATH 2196 DUSSELDORF V SER - RANGURY ENG

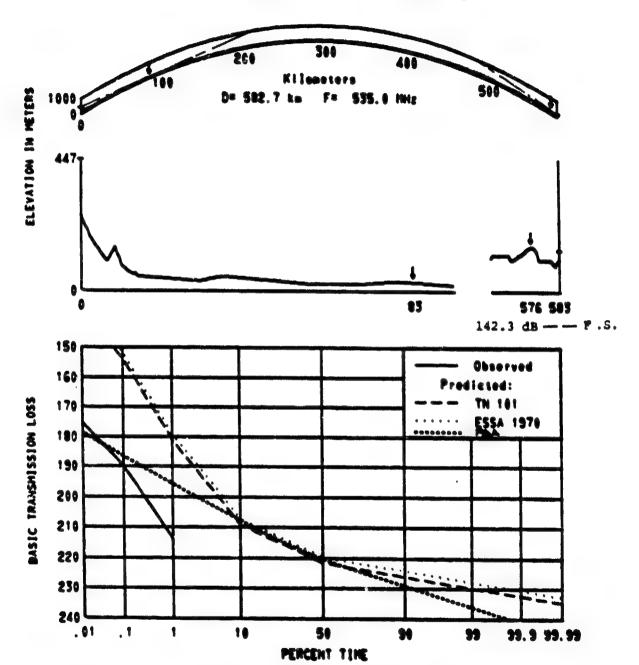
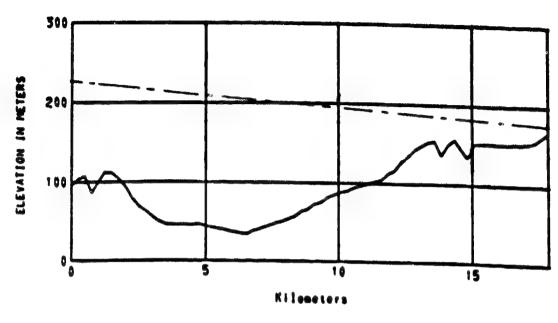


Figure 271. Path 12196, profile and predictions.

Path Number:	1 2 1 9	6	
Code Number: 1 1 2 5 3 0 0	4 5 2 1 1	3 4 1 1	
Location: Dusseldorf, West Gen	many - Banbury, E	ingland	
Data type 13000 hourly medians	_, Distance588	1.7 km,h 30	m-ms l
N 315 N-units a 8729	km, Surface typ	e average ground	
Climate maritime temperate overl	and	de	km
Frequency 535 MHz, Transmitt	er output	dBW, EIRP	dBW
5h 91.4 m, 8 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	447.1	142	
gain [dBi], main beam			
height [m], above site surface		31.4	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		7.1	
elevation [m-msl]		153.	
elevation angle [deg]			
Location, latitude	51°20'N	52°02'05"N	
longitude	7°02'E	1°18'50"W	
Path bearing			
clevation [m-ms1]			
Other information:			

Figure 272. Path 12196, parameters.

CRYSTAL PALACE ENG - KINGSWOOD ENG PATHS 2197 2198 2214



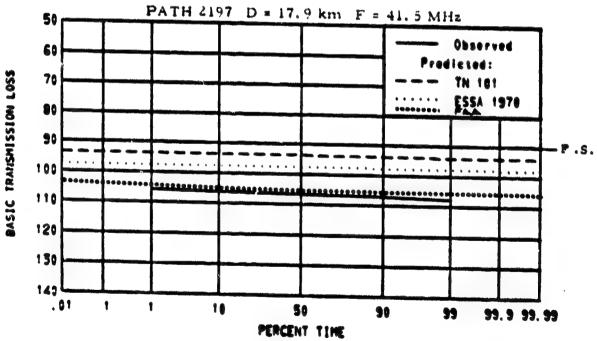


Figure 273. Path 12197, profile and predictions.

Path Number:	1 2 1 9	7	
Code Number: 1 1 2 0 1 0 0	4 5 2 1 1	3 1 1 1	
Location: Crystal Palace, Engli	and - Kingswood,	England	
Data type 1329 hourly medians N _S 317 N-units, a 8766	_, Distance17	.9 km,h 150	m-ms1
N _s 317 N-units, a 8766	_km, Surface typ	e average ground	
Climate maritime temperate overla	nd	de	km
Frequency 41.5 MHz, Transmitt	er output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	226.5	176.7	
gain [dBi], main beam			
height [m], above site surface		9.1	
line loss [dB]			
polarization	V	V	
type			
Horizon distance (km)			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	51°25'20"N	51°17'20"N	
longitude	0°04'17"W	0°12'50"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 274. Path 12197, parameters.

CRYSTAL PALACE ENG - KINGSWOCD ENG

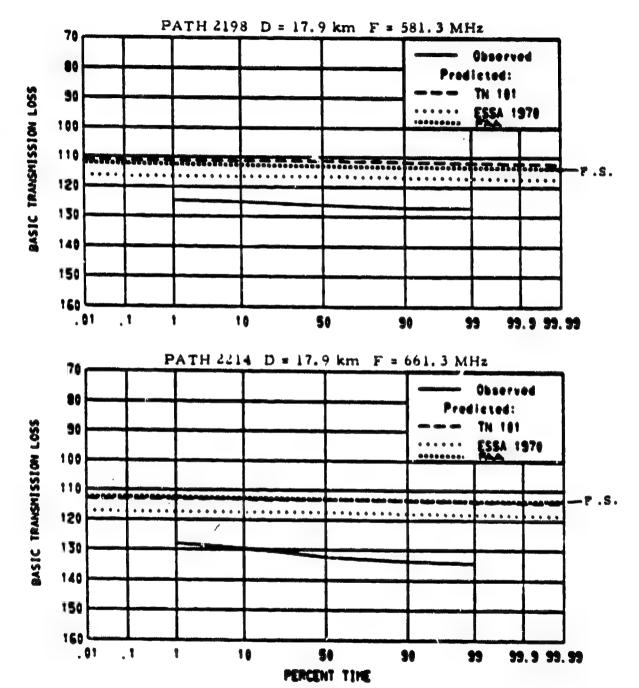


Figure 275. Paths 12198 and 12214, predictions. (see Figure 273 for profile)

Path Number: Code Number: 1 1 2 5 1 0 Location: Crystal Palace, Eng. Data type 958 hourly medians	land - Kingswood,	3 1 1 1 England	
N _s 317 N-units, a 8766	km. Surface tvi	oe average ground	m-ms 1
Climate maritime temperate overli	and	de	
Frequency 581.2 MHz, Transmit Δh 0 m, θ mr.	ter output	dBW, EIRP	dBW
	Transmitter	Receiver	
Antenna elevation [m-ms1] gain [dBi], main beam	295.	176.7	
height [m], abova site surface		9.1	
line loss (d8) polarization	Н		
type			
Horizon distance [km] elevation [m-ms] elevation angle [deg]			
Location, laritude	51°25°20"N 0°04°17"W	51°17'20"N	
Path bearing	U U4*17*W	0°12'50"W	
elevation [m-ms1]			

Figure 276. Path 12198, parameters.

Path Number:	1	4	
Code Number: 1 1 2 6 1 0 0	4 5 2 1 1	3 1 1 1	
Location: Crystal Palace, Engl			
Data type 1329 hourly medians	, Distance 17.	9 km, h 150	m-ms.l
N ₂ 317 N-units, a 8766	km. Surface tv	pe average ground	
Climate maritime temperate overlan	d	de	km
Frequency 661,2 MHz, Transmitt	er output	dBW. EIRP	dBW
Δh0 m, θ mr.			
	_		
	Transmitter	Receiver	
Antenna elevation [m-msl]	307.2	176.7	
gain [dBi], main beam			
height [m], above site surface		9.1	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msi]			
elevation angle [deg]			
Location, latitude	51°25'20"N	51°17'20"N	
long i t ude	0°04'17"W	0°12'50"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 277. Path 12214, parameters.

PATHS 2199 2216 DORTMUND W GER - ALDEBURGH ENG

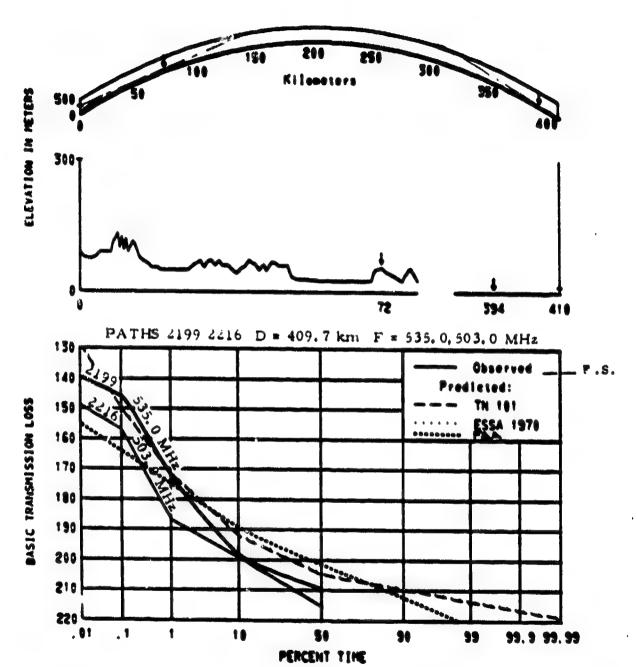


Figure 278. Paths 12199 and 12216, profile and predictions.

Path Number: Code Number: 1 1 2 5 3 0 Location: Dortmund, West Germ Data type 5000 hourly medianu N _S 316 N-units, a 8743 Climate maritime temperate over	many - Aldeburgh, E 5 , Distance 409 7 km, Surface typ	3 4 1 1 ngland .7 km, h 0 e sea water	m-ms 1
Frequency 535 MHz, Transmi			dBW
Δh 0 m, θ mr			
	Transmitter	Receiver	
Antenna elevation [m-msl]	299.9	14	
gain [dBi], main beam			
height [m], above site surface		13.7	
line loss [dB]	-		
polarization	Н	Н	
type			
Horizon distance [km]			,
elevation [m-msl]			
elevation angle [deg]			ı
Location, latitude	51° 30' 55*N	52°08'50"N	
longitude	7°27'24"E	1°36'15"E	,
Path bearing			
elevation [m-msl]			
Othur Informations			

Figure 279. Path 12199, parameters.

0 4 5 3 1 1 any - Aldeburgh, ans, Distance 40 7 km, Surface ty ter output	3 4 1 1 England 9.7 km,hrs 0 pe sea water de	km km
Transmitter 299.9	14 13.7	- - -
51°30'55"N 7°27'24"E	52 ⁰ 08'50"N 1 ⁰ 36'15"E	
	0 4 5 3 1 1 nany - Aldeburgh, nans, Distance 40 7 km, Surface ty ter output Transmitter 299.9 H	7 km, Surface type sea water de d

Figure 280. Path 12216, parameters.

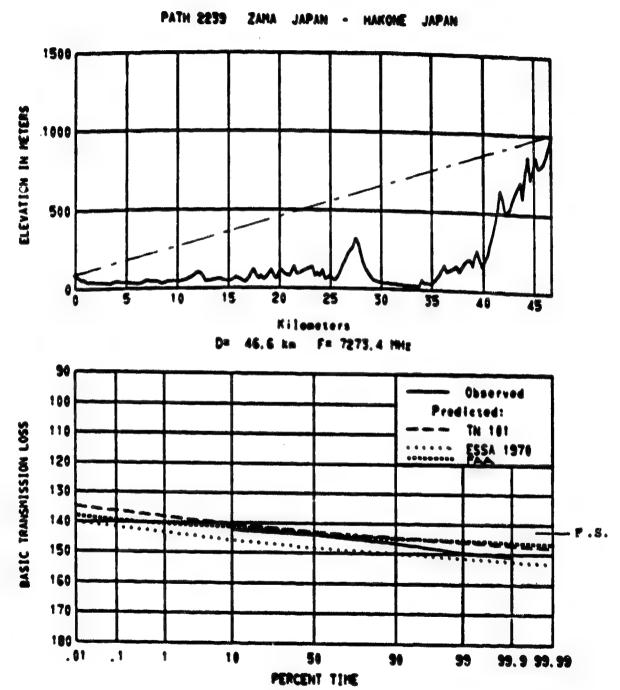
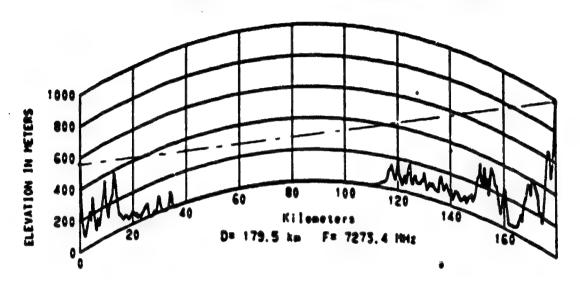


Figure 281. Path 12239, profile and predictions.

Path Number:	1 2 2 3	9	
Code Number: 1 1 3 7 1 0		-	
Location: Zama, Japan - Hakon		· 	
Data type 2100 hourly medians	, Distance46	.6 km.h 82	m-ms l
N 301 N-units, a 8493	km, Surface ty	pe average around	
Climate continental temperate		de	km
Frequency 7273.4 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 548.6 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	85.9	1003.6	
gain [dBi], main beam			
height [m], above site surface	3.9		
line loss [dB]			
polarization	Н	H	
type			
Horizon distance [km]		46.6	
elevation [m-msl]		999.7	
elevation angle [deg]	•		
Location, latitude	35°29'52"N	35°11'08"N	
longitude	139°24'04"E	139°03'27"E	
Path bearing		٠	
elevation [m-ms1]			i
Other information:			

Figure 282. Path 12239, parameters.





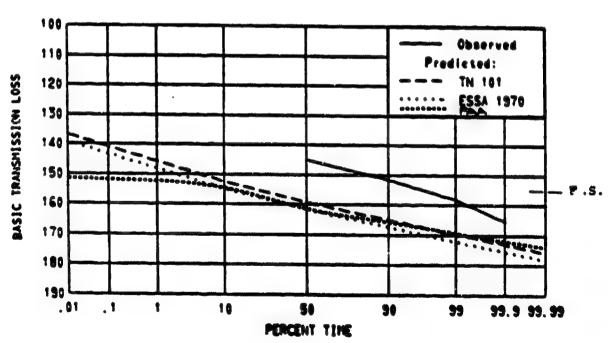


Figure 283. Path 12243; profile and predictions.

Code Number: 1 1 3 7 1 0 Location: Sofu, Japan - Sebun	iyama, Japan	4 5 1 1	
Data type 800 hourly medians	Distance 179	0.5 km, h _{rs} 0	m-ms l
N _s 301 N-units, a 849	3 km, Surface ty	pe sea water	
Climate continental temperate		, de	km
rrequency 7273.4 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	561	989	
gain [dãi], main beam			
height [m], above site surface	6		
line loss [dB] •		**************************************	
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]		· ·	
Location, latitude	34°04'06"N	33°25'17"N	
longitude	132°09'21E	130°22'46"E	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 284. Path 12243, parameters.

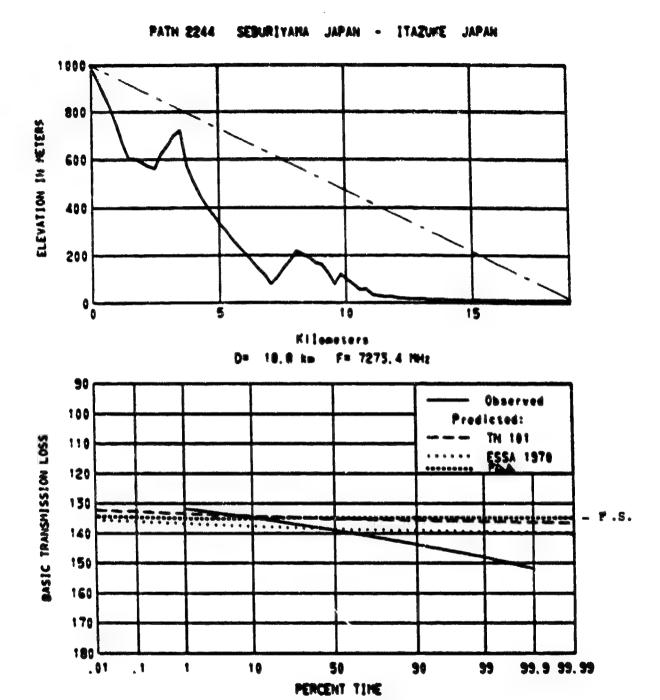
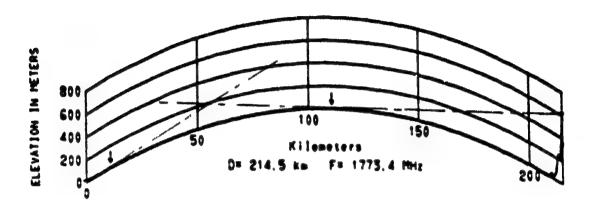


Figure 285. Path 12244, profile and predictions.

Path Number: Code Number: 1 1 3 7 1 0 0 Location: Seburiyama, Japan -	4 5 2 1 1		
Data type 700 hourly medians		.8 km,h 9.1	m-ms l
N _s 301 N-units, a 8493	km, Surface ty	e average ground	
Climate continental temperate		de	ikm
Frequency 7273.4 MHz, Transmitt			dew
Δh <u>697.4 m</u> , θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	998.2	13	
gain (dBi), main beam			
height [m], above site surface		3.9	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		18.8	
elevation [m-msl]		983.	
elevation angle [deg]			
Location, latitude	33°25'17"N	35 ⁰ 34'57"N	
longitude	130°22'46"E	130°26'35"E	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 286. Path 12244, parameters.



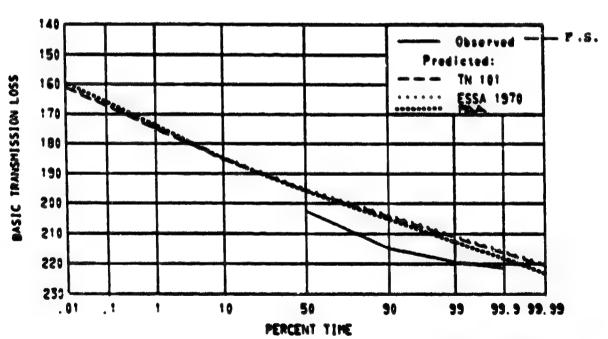


Figure 287. Path 12245, profile and predictions.

Path Number: Code Number: 1 1 3 1 3 0 Location: Itazuke, Japan - Cl Data type 1400 hourly mediana N _S 314 N-units, a 87 Climate continental temperate	hangsan, Japan S., Distance 214 11 km, Surface ty	4 5 1 1 1.5 km,h _{rs} 0 pe sea water	m-ms l
Frequency 1773.4 MHz, Transmi	tter output	dBW, EIRP	dBW
Δh <u>0</u> m, θ mr	•		
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface line loss [dB] polarization	Transmitter 17.1 8.0	Receiver 623	
type			
Horizon distance [km] elevation [m-msl] elevation angle [deg]	10.90		
Location, latitude	33° 34' 57"N	35°11'27"N	
longitude	130°26'35"E	129°08'48"E	
Path bearing elevation (m-ms)			

Figure 288. Path 12245, parameters.

PATH 2247 CHIRAN JAPAN - YAETAKE JAPAN

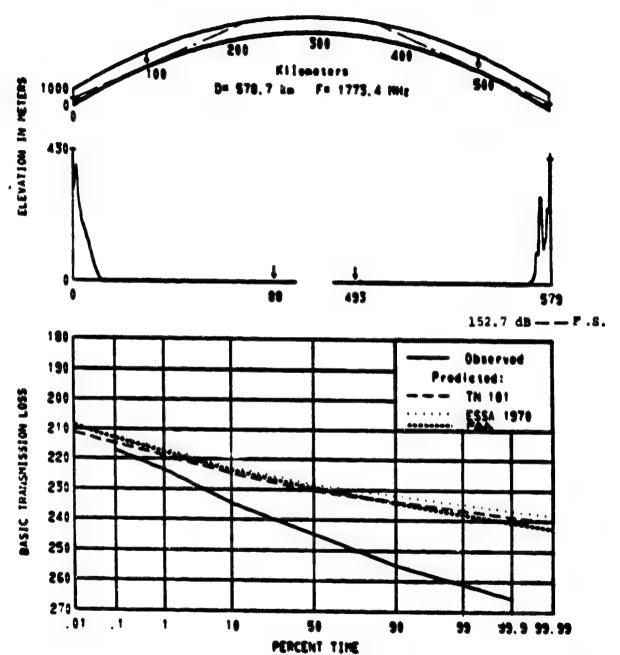


Figure 289. Path 12247, profile and predictions.

Location: Chiran, Japan - Yae Data type 2500 hourly medians N _s 327 N-units, a 895 Climate continental temperate	Distance 578 , Distance 578 , Surface ty	.7 km,h 0 pe_sea_water	
Frequency 1773.4 MHz, Transmit	ter output	dBW, EIRP	km d BV
Antenna elevation [m-ms1] gain [dBi], main beam	Transmitter 429.5	Receiver 414.8	
height [m], above site surface line loss [dB]		12.5	
polarization type	Н	Н	
Horizon distance [km] elevation [m-msl] elevation angle [deg]			
Location. latitude	31°20'31"N 130°29'25"E	26°37'48"N 127°55'22"E	
Path bearing elevation [m-ms1] Other information:			

Figure 290. Path 12247, parameters.

PATHS 2259 2260 TOKYO TOWER JAPAN - KOGA JAPAN

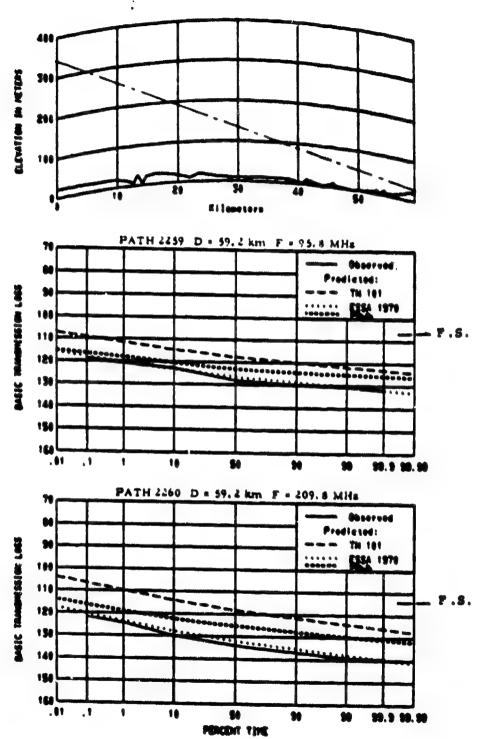


Figure 291. Paths 12259 and 12260, profile and predictions.

Path Number: Code Number: 1 1 2 0 1 0 Location: Tokyo Tower, Japan Data type 655 hourly medians N 309 N-units, a 862 Climate continental temperate Frequency 95.8 MHz, Transmi Ah 10.5 m, 0 mr	- Koga, Japan, Distance! km, Surface ty	1 4 5 1 1 59.2 km, h 15 pe average ground	m-ms 1 km d8W
Antenna elevation [m-msl] gain [dBi], main beam height [m], above site surface line loss [dB]	Transmitter 340.2	Receiver 29	
polarization type	Н	Н	
<pre>Horizon distance [km] elevation [m-msi] elevation angle [deg]</pre>		18.	
Location, latitude longitude Path bearing elevation [m-msl] Other information:	35 ⁰ 39'18.1"N 139 ⁰ 44'56.4"E	36 ⁰ 11'14.5"N 139 ⁰ 42'19.8"E	

Figure 292. Path 12259, parameters.

Path Nu	ımber:	1 2	2 6 0			
Code Number: 1 1 2	2 1 0 0 4	5 2	114	5 1 1		
Location: Tokyo To				•		
Data type 889 hour				km,h	15	m-ms1
N 309 N-unit						
Climate continental t						km
Frequency 209.8 MH						dBW
Δh 10.5 m, θ				_		
		Transmitt	er	Receiver		
Antenna elevation [m-ms		317.6		29		
gain [dBi], main beam	n					
height [m], above sit	te surface			10		
line loss [dB]						
polarization		Н		Н		
type						
Horizon distance [km]				18.		
elevation [m-ms]]				10.		
elevation angle [deg]					
Location, latitude	3:	5039'18.1	"N	36°11'14.5	"N	
longitude	13	9044156.4	"E	139042'19.8	"E	
Path bearing						
elevation [m-msl]						
Other information:	-					

Figure 293. Path 12260, parameters.,

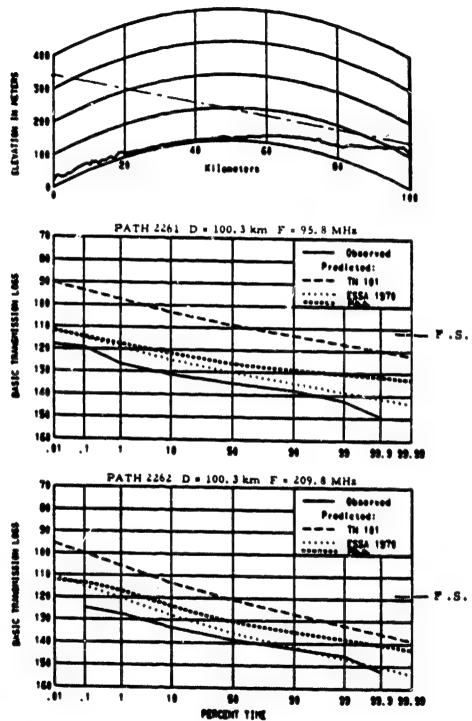


Figure 294. Paths 12261 and 12262, profile and predictions.

Path Number: Code Number: 1 1 2 0 1 0 0 Location: Tokyo Tower, Japan - Data type 4889 howrly medians	4 5 2 1 1 Utsunomiya, Japa , Distance 10	4 5 1 1 0.3 km, h _{rs} 50.	m-ms 1
N _s 302 N-units, a 8509			
Climate continental temperate		, de	
Frequency 95.8 MHz, Transmitt Δh 0 m, θ mr.	ter output	dow, EIKP	dBW
an m, e mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	340.2	139	
gain [dBi], main beam			
height [m], above site surface		10	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deq]			
Location, latitude	35°39'18,1"N	36°33'24,3"N	
longitude	139°44'56.4"E	139°49'47.3"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 295. Path 12261, parameters.

Path Number:	1 2 2 6	?	
Code Number: 1 1 2 2 1 0	0 4 5 2 1 1	4 5 1 1	
Location: Tokyo Tower, Japan	- Utsunomiya, Jap	an	
Data type 3675 hourly medians			
N _s 302 N-units, a 850	9 km, Surface ty	pe <u>average ground</u>	
Climate continental temperate		, de	km
Frequency 209.8 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 0 m, θ mr.		٠.	
	Transmitter	Receiver	
Antenna elevation [m-ms1]	317.6	139	
gain [dBi], main beam			
height [m], above site surface		10	
line loss [dB]		:	
polarization	Н	H	
type .			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deq]			
Location, latitude	35° 39' 18.1"N	36°33'24.3"N	
longitude	139044156.4"E	139°49'47.3"E	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 296. Path 12262, parameters.



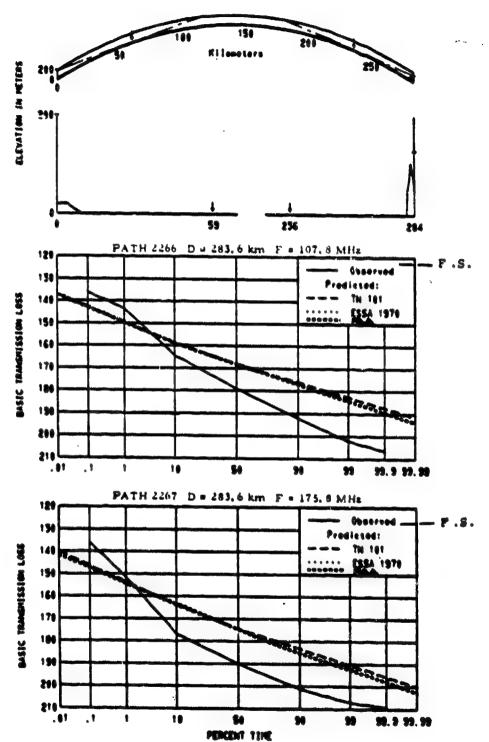


Figure 297. Paths 12266 and 12267, profile and predictions.

Path Number:			
Location: Tokyo Tower, Japan			
Data type 2163 hourly medians	, Distance 283	.6 km,h 0	m-ms1
N 310 N-units, a 8641	km, Surface typ	e sea water	
Climate continental temperate		de	km
Frequency 107.8 MHz, Transmit			dBW
$\Delta h = 0 \qquad m, \ \theta = mr.$			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	200	130	
gain [dBi], main beam			
height [m], above site surface		80	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude	35°40'20"N	33°06'55"N	
longitude	139°44'25"E	139°47'50"E	
Path bearing			
elevation [m-msl]			
Other information.			

Figure 298. Path 12266, parameters.

Path Number: Code Number: 1 1 2 1 3 0 0 Location: Tokyo Tower, Japan - Data type 1129 hourly medians	4 5 3 1 1 Hachijo, Japan	4 5 1 1	m-ms l
N _s 310 N-units, a 8641	km, Surface typ	e sea water	
Climate continental temperate		de	km
Frequency 175.8 MHz, Transmitt	ter output	dBW, EIRP	dBW
$\Delta h = 0 m, \theta = mr.$			
	Transmitter	Receiver	
Antenna elevation [m-msl]	200	130	
gain [dBi], main beam			
height [m], above site surface		80	
line loss [dB]			
polarization	H	Н	
type			,
Horizon distance [km]			•
elevation [m-msl]			
elevation angle (deg)			
Location, latitude	35°40'20"N	33 ⁰ 06155"N	
longitude	139044'25"E	159047'50"E	
Path bearing			•
elevation [m-msl]			
Oshun tufnamasians			

Figure 299. Path 12267, parameters.

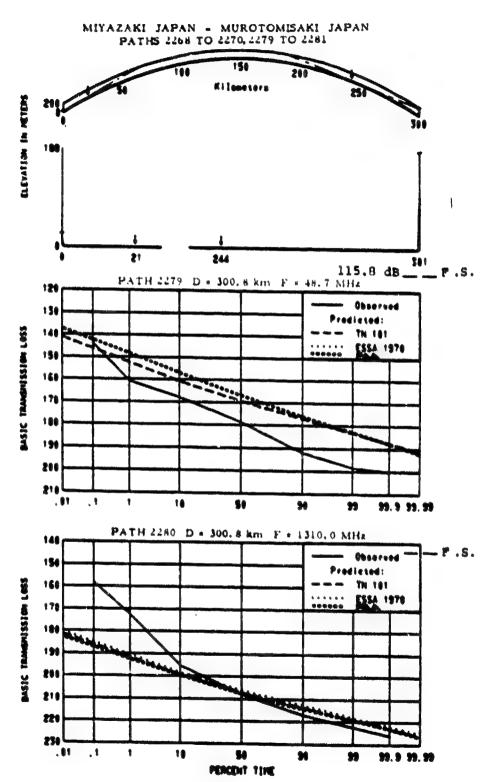


Figure 300. Paths 12279 and 12280, profile and predictions.

Path Number: Code Number: 1 1 2 0 3 0 Location: Miyazaki, Japan - M Data type 1787 hourly medians	<u>0 4 5 3 1 1</u> vrotomisaki, Japa	<u>4 5 1 1</u>	m~ms l
N 306 N-units, a 85	74 km. Surface ty	pe sea water	m-ms i
Climate continental temperate		de	km
Frequency 48.7 MHz, Transmit	ter output	JBW, EIRP	dBW
	Transmitter	Receiver	
Antenna elevation [m-ms1]	25	188	
gain [dBi], main beam			
height [m], above site surface	10		
line loss (dB)			
polarization	Н	н	
type			
Horizon distance [km]			
elevation [m-ms]]			
elevation angle (deg)			
Location, latitude	31°48'00"N	33°14'38"N	
longitude	131°27'56"E		
Path bearing			
elevation [m-msl]			
Other information:			

Figure 301. Path 12279, parameters.

Path Number: Code Number: 1 1 3 1 3 0 Location: Miyazaki, Japan - M Data type 1744 hourly medians N _s 306 N-units a 857 Climate continental temperate	0 4 5 3 1 1 wrotomisaki, Japa , Distance 30 4 km. Surface ty	4 5 1 1 0.8 km, h _{rs} 0	m-ms1
Frequency 1310 MHz, Transmit	ter output	dBW, EIRP	KIII
Δh 0 m, θ mr.			504
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface line loss [dB] polarization type	Transmitter 20 5	Receiver 185	
Horizon distance [km]			
elevation [m-ms]]			
elevation angle [deg]			
Location, latitude	31 ⁰ 48'00"N	33 ⁰ 14'38"N	
longitude	131°27'56"E	134°10'39"E	
Path bearing			
elevation [m-ms1]			
Others a tender man a trans			

Figure 302. Path 12280, parameters.

MIYAZAKI JAPAN - MUROTOMISAKI JAPAN

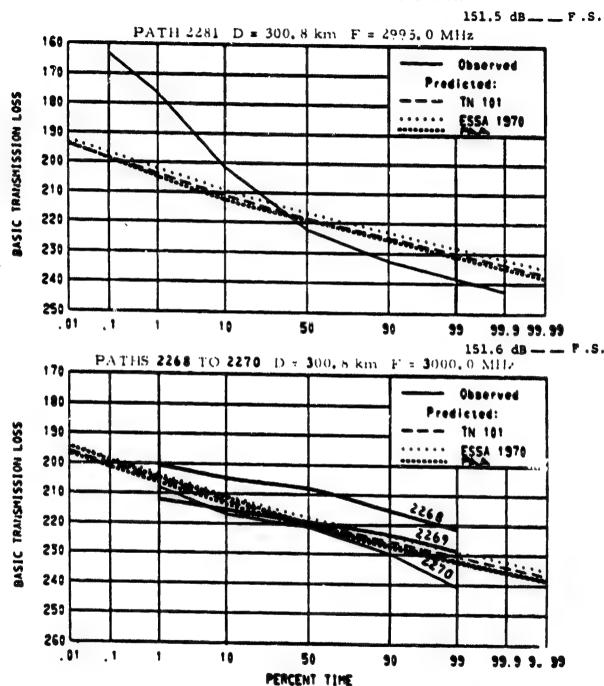


Figure 303. Paths 12281 and 12268 through 12270, predictions. (see Figure 300 for profile)

Path Number: Code Number: 1 1 3 2 3 0 Location: Miyazaki, Japan - N Data type 1668 hourly medians N _S 306 N-units, a 8574	0 4 5 3 1 1 Wrotomisaki, Japa , Distance 3 km, Surface ty	4 5 1 1 in in in in in in in in in in in in in	
Climate continental temperate		de	km
Frequency 2995 MHz, Transmit	ter output	dBW, EIRP	dBW
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface line loss [dB] polarization type	Transmitter 20 5	Receiver 185	- - -
Horizon distance [km] elevation [m-ms1] elevation angle [deg] Location, latitude longitude Path bearing elevation [m-ms1]	31°48'00"N 131°27'56"E	33°14'38"N 134°10'39"E	- - -

Figure 304. Path 12281, parameters.

Path Number:	1 2 2 6	8	
Code Number: 1 1 3 3 3 0	045311	4 5 1 1	
Location: Miyazaki, Japan - M	vrotomisaki, Japa	N.	
Data type 339 hourly medians	, Distance3	00.8 km.h 0	m-ms l
N 306 N-units a 8574	km Surface tw	ne Aga water	
Climate continental temperate		de	km
Frequency 3000 MHz, Transmit	ter output	dBW. FIRP	dBW
$\Delta h = 0 m, \theta mr.$			
Amhana ahaasa fa sh	Transmitter	Receiver	
Antenna elevation [m-ms1]	20	185	
gain [dBi], main beam			
height [m], above site surface	5		
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	31°48'00"N	33°14'38"N	
longitude	131°27'56"E	134°10'39"E	
Path bearing			
elevation [m=msl]			
Other information:			

Figure 305. Path 12268, parameters.

Path Number: Code Number: 1 1 3 3 3 0 (
Location: Miyazaki, Japan - Mu			
Data type 364 hourly medians	•		m-ms l
N _c 306 N-units, a 8574			(11-111-3 t
Climate continental temperate			km
Frequency 3000 MHz, Transmit			dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	20	151.5	
gain [dBi], main beam			
height [m], above site surface	5		
line loss [dB]			
polarization	Н	Н	
type			
H +zon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	31°48'00"N	33 ⁰ 14'38"N	
longitude	131°27'56"E	134 ⁰ 10'39"E	
Path bearing			
elevation [m-ms1]			
Other informations			

Figure 306. Path 12269, parameters.

Path Number:	1 2 2 7	<u>o</u>	
Code Number: 1 1 3 3 3 0 (0 4 5 3 1 1	4 5 1 1	
Location: Miyazaki, Japan - Mu	ırotomisaki, Japan	t	
Data type 334 hourly medians	, Distance30	0.8 km.h 0	m-ms 1
N 306 N-units, a 8574			
Climate continental temperate			km ·
Frequency 3000 MHz, Transmit			dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	20	107	
gain [dBi], main beam			
height [m], above site surface	5		
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	31°48'00"N	33 ⁰ 14'38"N	
longitude	131°27'56"E	134°10'39"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 307. Path 12270, parameters.

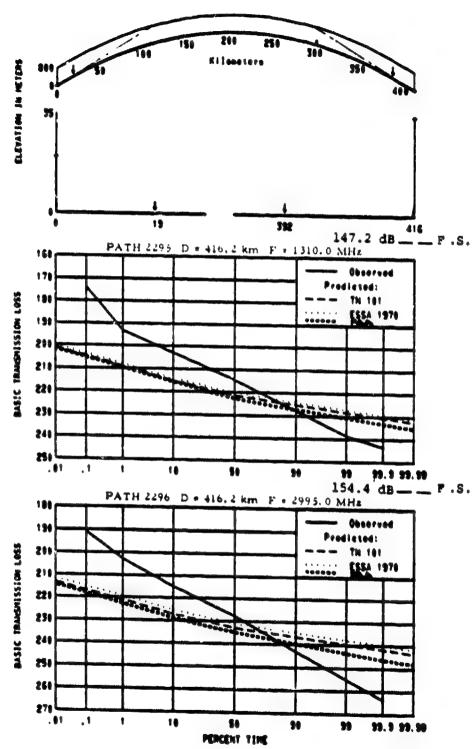


Figure 308. Paths 12295 and 12296, profile and predictions.

Path Number:	1 2 2 9	_5	
Code Number: 1 1 3 1 3 0 0			
Location: Miyazaki, Japan - In	ami, Japan		
Data type 1573 hourly medians	, Distance 4	16.2 km,h 0	m-ms 1
N ₂ 306 N-units, a 8574			
Climate continental temperate		, de	km
Frequency 1310 MHz, Transmitt			dBW
$\Delta h = 0 \qquad m_{+} \; \theta = m_{T},$			
	Transmitter	Receiver	
Antenna elevation [m-msl]	20	35	
gain [dBi], main beam			
height [m], above site surface	5		
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude		33°48'11"N	
long i t ude	131 ⁰ 27'56"E	135°13'32"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 309. Path 12295, parameters.

Path Number: Code Number: 1 1 3 2 3 0 (Location: Miyazaki, Japan - 1: Data type 1674 hourly medians N _s 306 N-units, a 8574	0 4 5 3 1 1 nami, Japan, Distance416 kmSurface_ty	4 5 1 1 .2 km, h _{rs}	
Climate continental temperate		de	km
Frequency 2995 MHz, Transmit	ter output	dBW, EIRP	daw
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	20	35	
gain [dBi], main beam			
height [m], above site surface	5		
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation (m-ms1)			
elevation angle [deg]			
Location, latitude	31°48'00"N	33°48'11"N	
longitude	131°27'56"E	135°13'32"E	
Path bearing			
elevation [m-ms]]			
Other information:			

Figure 310. Path 12296, parameters.

BADEN-BADEN W GER - DARMSTADT W GER PATHS 2350 TO 2355,2378

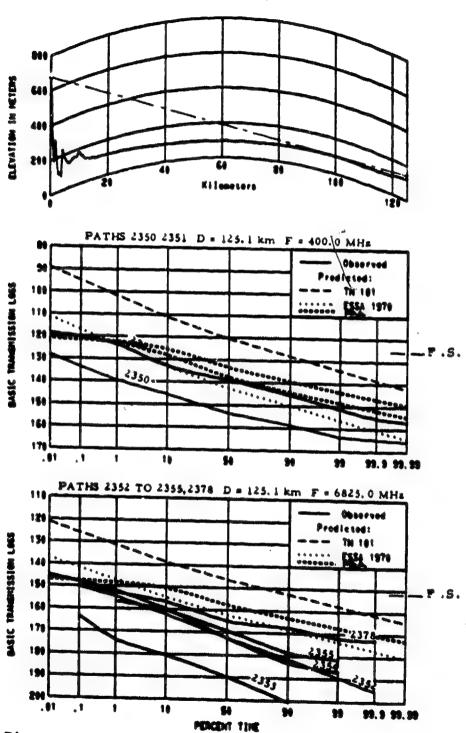


Figure 311. Paths 12350 through 12355 and 12378 profile and predictions.

		1 2 3 5		
Code Number: 1 1	2 4 1 0 0	4 5 2 1 1	3 2 1 1	
Location: Baden				
Data type 6772 h	ourly medians	Distance 125.	1 km,h_ 90	m-ms 1
			average ground	
Climate continental				km
Frequency 400 M				dBW
3h0_m, e				-
		Transmitter	Receiver	
Antenna elevation [m-m	·s1]	677	147	
gain [dBi], main bea	nı _			
height [m], above si	te surface		21	
line loss [dB]	•			
polarization	993.0	Н	Н	
type	•			
Morizon distance [km]				
elevation [m-ms1]				
elevation angle [deg	i)			
Location, latitude	_	48°45'51.2"N	49°51'54"N	
longitude	-	8º16'51.5"E	8°37'33"E	
Path bearing	-			
elevation [m-msl]				
015				

Figure 312. Path 12350, parameters.

Path Number: Code Number: 1 1 2 4 1 0 0 Location: Baden Baden, West Ger	4 5 2 1 1	3211	
Data type 1042 hourly medians			m-ms 1
N 291 N-units, a 8342	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 400 MHz, Transmitt			dBW
Ah 0 m, 0 mr.			
	Transmitter	Receiver	
Anrenna elevation [m-ms]]	617		
crin [dBi], main beam			
neight [m], above site surface		41.5	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msi]			
elevation angle [deg]			
Location, latitude	48°45'51.2"N	49°51'54"N	
longitude	1016151.5"E	4°37'33"E	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 313. Path 12351, parameters.

Path Number:	1 2 3 5	2	
Code Number: 1 1 3 6 1 0 0	4 5 2 1 1	3 2 1 1	
Location: Baden Baden, West Ge	rmany - Darmstadi	, West Germany	
Data type 8623 hourly medians	, Distance 125.	1 km, h 90	m-ms l
N _s <u>291</u> N-units, a <u>8342</u>	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 6825 MHz, Transmitt	er output	dBW, EIRP	dBW
2h 0 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	699	167.5	
gain [dBi], main beam			
height [m], above site surface		41.5	
line loss [dB]			
polarization	Н	н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude	48°45'51.2"N	49°51'54"N	
longitude	8016'51.5"E	8°37'33"E	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 314. Path 12352, parameters.

Path Number:	1 2 3 5	3	
Code Number: 1 1 3 6 1 0 0			
Location: Baden Baden, West Ger			
Data type 3880 hourly medians	, Distance 125	1 km, h 90	m-ms l
N 291 N-units, a 8342	_km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 6825 MHz, Transmitte	er output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms]]	699	147	
gain [dBi], main beam			
height (m), above site surface		21	
line loss (dB)			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msl]			
elevation angle [deg]			
Location, latitude	48°45'51.2"N	49°51'54"N	
longitude	8° 16' 51.5"E	8 ⁰ 37'33"E	
Path bearing			
elevation [m-msl]			
Other information:			

"igure 315. Path 12353, parameters.

Code Number: 1 1 3 6 1 0 Location: Baden Baden, West (Data type 4897 hourly median N _S 291 N-units, a 8342 Climate continental temperate	Germany - Darmstad . Distance 12 km, Surface ty	3 2 1 1 t, West Germany 5.1 km,h 90 pe average ground de	m-ms 1 km
Ah 0 m, 0 mr.	iter output	dBW, EIRP	d8W
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface line loss [dB] polarization type	Transmitter 699	154 28	
Horizon distance [km] elevation [m-msl] elevation angle [deg]			
Location, latitude	48°45'51.2"N	49°51'54"N	
longitude	4º16'51.5"E	8 ⁰ 37'33"E	
Path bearing elevation [m-ms1] Other information:			

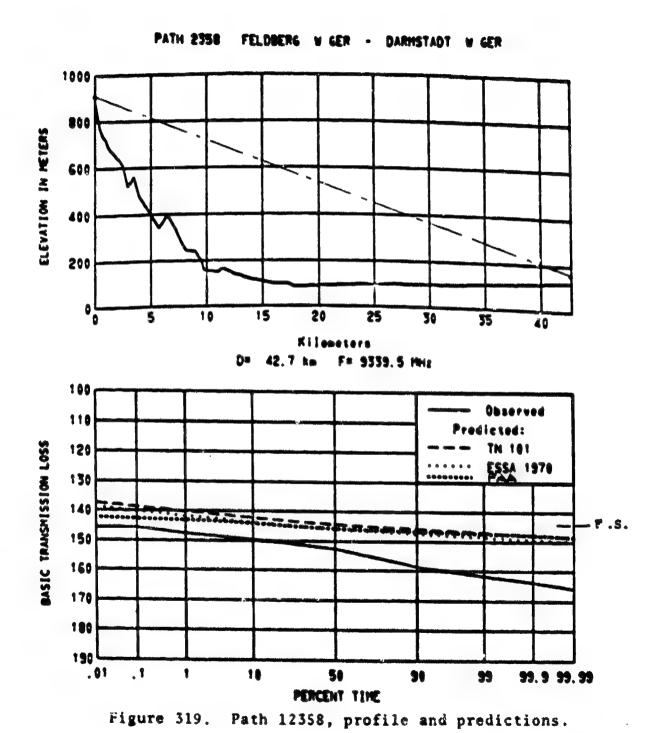
Figure 316. Path 12354, parameters.

Path Number:	_1 235	5	
Code Number: 1 1 3 6 1 0 0	4 5 2 1 1	3211	
Location: Baden Baden, West Ger	many - Darmstadt	, West Germany	
Data type 6932 hourly medians	, Distance 12	5,1 km,h 90	m-ms l
N. 291 N-units, a 8342	_km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 6825 MHz, Transmitte			dBW
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	699	167	
gain [dBi], main beam			
height (m), above site surface		41	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms]		an agrant and agrant and agrant and agrant agran	
elevation angle [deg]			
Location, latitude	48°45'51,2"N	49°51'54"N	
longitude	8º16'51.5"E	8°37'33"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 317: Path 12355, parameters.

Path Number: Code Number: 1 1 3 6 1 0 Location: Baden Baden, West of the second seco	Germany - Darmstag 6, Distance12 2km, Surface ty tter output	3 2 1 1 It, West Germany 5.1 km, h 90 pe_average ground de	m-ms km d&W
Antenna elevation [m-ms] gain [dBi], main beam height [m], above site surface	<u>Transmitter</u> 699	167.5 41.5	
line loss [d8] polarization type	Н	Н	
Horizon distance [km] elevation [m-ms1] elevation angle [deg]			
Location, latitude longitude Path bearing elevation [m-msl] Other information:	48 ⁰ 45'51.2"N 8 ⁰ 16'51.5"E	49°51'54"N 8°37'33"E	

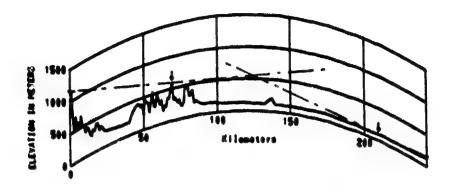
Figure 318. Path 12378, parameters.

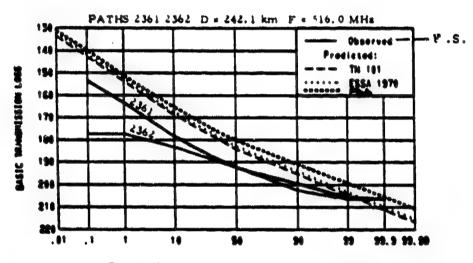


Code Number: 1 1 3 9 1 0 Location: Feldberg, West Ge Data type 14360 hourly median N _S 296 N-units, a 841 Climate continental temperate	ermany - Darmstadt 18 , Distance 42 6 km, Surface ty	3 2 1 1 West Germany 7 km,h 100 pe_average_ground de	m-ms km
Frequency 9339.5 MHz, Transmit 5h 419.9 m. 8 mr.	tter output	dBW, EIRP	dBW
Antenna elevation [m-ms]] gain [dBi], main beam	Transmitter 910	Receiver 159	
height [m], above site surface		33	
line loss [dB]			
polarization type	—	Н	
Horizon distance [km] elevation [m-ms1] elevation angle [deg]		42.7	
Location, latitude	50°13'59.2"N	49°51'54"N	
longitude	8°27'32.7"E		
Path bearing elevation [m-ms1]			
Other information:			

Figure 320. Path 12358, parameters.

PATHS 2360 TO 2362 HOCHBLAUEN W GER - DARMSTADT W GER





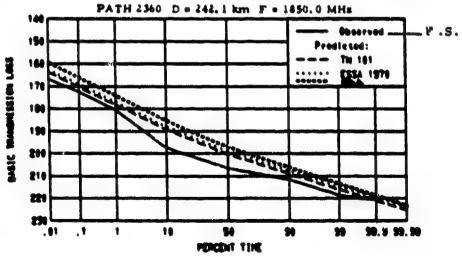


Figure 321. Paths 12360 through 12362, profile and predictions.

Path Number: Code Number: 1 1 2 5 3 0 Location: Hochblauen, West G Data type 4137 hourly median N _S 294 N-units, a 8386 Climate continental temperate Frequency 516 MHz, Transmi th 193.9 m, 0 mr	ermany - Darmstad b . Distance 24 km, Surface t	1 3 2 1 1 t. West Germany 12.1 km.h 97 ype average ground	m-ms } km dBW
Antenna elevation [m-ms1]	Transmitter 1165	Receiver 164	
gain [dBi], main beam height [m], above site surface line loss [dB]		38	
polarization type	Н	Н	
<pre>Horizon distance [km] elevation [m-ms1] elevation angle [deg]</pre>		32.72 97	
Location, latitude longitude	47°45'19"N 7°42'06"E	49°51'54"N 8°37'33"E	
Path bearing elevation [m-ms] Other information:			

Figure 322. Path 12361, parameters.

Path Number:	: 1 2 3 6	2	
Code Number: 1 1 2 5	3 0 0 4 5 2 1 1	3 2 1 1	
Location: Hochblauen, W	lest Germany - Darmstadt,	West Germany	
Data type 504 hourly me	dians , Distance 242	.1 km, h 97	m-ms 1
N 294 N-units, a	8386 km, Surface typ	e average ground	-
Climate continental temper			km
Frequency 516 MHz, Ti	ransmitter output	dBW, EIRP	dBW
δh 193.9 m, θ	mr.		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1165	160	
gain [dBi], main beam			
height [m], above site su	rface	34	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]	المطابقة والأدام والأطاق والمجانية والمجانية والمجانية والمجانية والمجانية والمجانية والمجانية والمجانية والمحا	32.72	
elevation [m-msl]		97	
elevation angle [deg]			
Location, latitude	47º46'19"N	49 ⁰ 51 ' 54"N	
longitude	7°42'06"E	8 ⁰ 37'33"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 323. Path 12362, parameters.

Path Number: Code Number: 1 1 3 1 3 0 Location: Hochblauen, West G	0 4 5 2 1 1	3 2 1 1	
Data type 6247 hourly median	•	•	m-ms l
N. 294 N-units, a 8386			111 111 31
Climate continental temperate			km
Frequency 1850 MHz, Transmit			dBW
Δh 193.9 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	1165	166.5	
gain [dBi], main beam			
height [m], above site surface		40.5	
line loss [dB]			
polarization	V	V	
type			
Horizon distance [km]		32.72	
elevation [m-ms1]		97.	
elevation angle (deg)			
Location, latitude	47 ⁰ 46'19"N	49 ⁰ 51'54"N	
longitude	7°42'06"E	8°37'33"E	
Path bearing			
elevation [m-msl]			
Other informations			

Figure 324. Path 12360, parameters.

HORNISGRINDE W GER - DARMSTADT W GER PATHS 2363 TO 2366,2440 TO 2443

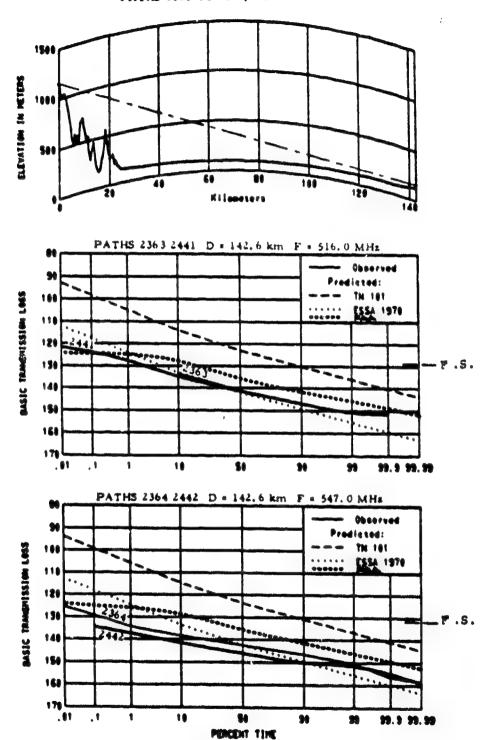


Figure 325. Paths 12363, 12441, 12364, and 12442, profile and predictions.

Path Number: Code Number: 1 1 2 5 1 0 Location: Hornisgrinde, West Data type 2100 hourly medians N _S 289 N-units, a 8314 Climate continental temperate Frequency 516 MHz, Transmit th 289.1 m, 0 mr.	O 4 5 2 1 1 Germany - Darmstac , Distance 142 km, Surface ty	3 2 1 1 It, West Germany 2.6 km.h 100 pe_average ground de	m-ms 1 km dBW
Antenna elevation [m-msl] gain [dBi], main beam	Transmitter 1150	Receiver 163.5	
height [m], above site surface line loss [dB]		37.5	
polarization type	Н	Н	
Horizon distance [km] elevation [sems]	•	142.6	
elevation angle [deg] Location, latitude	48°36'49.4"N	49°51'54"N	
longitude Path bearing	8°12'12.1"E	8°37'33"E	
elevation [n-ms]}			

Figure 326. Path 12363, parameters.

Path Number:	1 2 4 4	1	
Code Number: 1 1 2 5 1 0	0 4 5 2 1 1	3 2 1 1	
Location: Hornisgrinde, West	Germany - Darmstad	lt, West Germany	
Data type 4855 hourly medians			m-ms 1
N 239 k-units, a 8314	km, Surface typ	pe average ground	
Climate continental temperate			km
Frequency 516 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 289.1 m, n mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1150	170	
gain [dBi], main beam			
height [m], above site surface			
line toss [dB]			
polarization	Н	н	
type			
Horizon distance [km]		142.6	
elevation [m-msl]		1135.	
elevation angle [deg]			
Location, latitude	480 36 149 4MN	49051154MM	
longitude	8º12'12.2"E	8°37'33"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 327. Path 12441, parameters.

Path Number:	1 _2 _3 _6	4	
Code Number: 1 1 2 5 1 0			
Location: Hornisgrinde, Mcs			
Data type 6087 hourly media	ns , Distance 142	.6 km,h 100	m-ms l
N. 289 N-units a 8314	km. Surface tv	pe average ground	
Climate continental temperate		de	km
Frequency 547 MHz, Transm	itter output	dBW, EIRP	dBW
Ab 289.1 m, u m		***************************************	
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1153	162	
gain [dBi], main beam			
height [m], above site surface		36	
line toss [dB]			
polarization	H	Н	
type			
Horizon distance [km]		142.6	
elevation [m-ms1]		1135.	
elevation angle [deg]			
Location, latitude	48°36'49.4"N	49°51'54"N	
longitude	8°12'12.2"E	8° 37' 33"E	
Path bearing			
elevation [m-msl]		PROPERTY OF THE PROPERTY OF TH	
Other information:			

OT/*PER 16, 6ig. 1.36

Figure 328. Path 12364, parameters.

Path Number:	4 5 2 1 1	3 2 1 1	
Location: Hornisgrinde, West G Data type 8318 hourly medians	, Distance 142.6	km,h 100	m-ms 1
N 289 N-units, a 8314 Climate continental temperate	km, Surface ty	de	km
Frequency 547 MHz, Transmitt			dBW
Δh 289.1 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1153	163.5	
gain [dBi], main beam			
height [m], above site surface		37.5	
line loss [dB]		H	
polarization	. Н	П	
type		142.6	
Horizon distance [km] elevation [m-msl]		1135.	
elevation [m-ms1] elevation angle [deg]			
Location, latitude	48° 36' 49.4"N	49 ⁰ 51'54"N	
longitude	8°12'12.2"E	8 ⁰ 57'33"E	
Path bearing			
elevation [m-msl]		and the second control of the second control	
Other information:			

Figure 329. Path 12442, parameters.

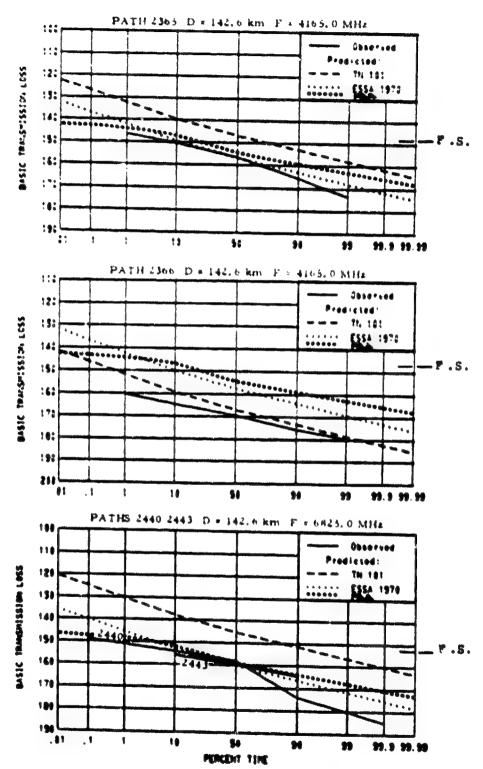


Figure 330. Paths 12365, 12366, 12440, and 12443, predictions. (see Figure 325 for profile)

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Path Number: Code Number: 1 1 3 4 1 0 Location: Hornisgrinde, West Data type 9986 hourly medians	0 4 5 2 1 1 Germany - Darmsta , Distance142	3 2 1 1 dt, West Germany .6 km,h 100	m-ms l
N _s <u>289</u> N-units, a <u>8314</u> Climate <u>continental temperate</u>	km, surrace ty	de average ground	km
Frequency 4165 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 289.1 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1155	163	
gain [dBi], main beam			•
height (m), above site surface		37	•
line loss [dB]			i.
polarization	Н	Н	•
type			•
Horizon distance [km]		142.6	
elevation [m-ms1]		1135.	1
elevation angle (deg)			
Location, latitude	48°36'49.4"N	49°51'54"N	
longitude	8°12'12.2"E	8° 37' 33"E	
Path bearing			
elevation [m-msl]			
Other information:			

OT/TRER 16. Sig. 1.37

Figure 331. Path 12365, parameters.

Path Number: Code Number: 1 1 3 4 1 0 Location: Hornisgrinde, West Germa Data type 13978 hourly medians No. 289 N-units, a 8314 Climate continental temperate Frequency 4165 MHz, Transmit	0 4 5 2 1 ny - Darmstadt, U , Distance 14 km, Surface to	1 3 2 1 1 West Germany 12.6 km,h, 100 ype average ground	m-ms 1 km d8W
Δh 289.1 m, θ mr.			
Antenna elevation [m-ms1] gain [dBi], main beam	Transmitter 1154	Receiver 147.5	
height [m], above site surface line loss [d8]		21.5	
polarization type	Н	Н	
Horizon distance [km] elevation [m-ms]] elevation angle [deq]		142.6 1135	
Location, latitude longitude	48° 36'49.4"N 8° 12'12.2"E	49°51'54"N 8°37'33"E	
Path bearing elevation [m-ms1]			

Figure 332. Path 12366, parameters.

Path Number: Code Number: 1 1 3 6 1 0 Location: Hornisgrinde, West Germ Data type 4276 hourly medians N. 289 N-units, a 8314	0 4 5 2 1 1 any - Darmstadt, Distance 142	3 2 1 1 West Germany .6 km,h 100	m-ms 1
Climate continental temperate			km
Frequency 6825 MHz, Transmitt			dew
Ah 289.1 m, e mr.	-		
	Transmitter	Receiver	
Antenna elevation [m-ms]]	1152	165	
gain [dBi], main beau			
height [m], above site surface		39	
line loss [dB]			
polarization	K	Н	
type			
Horizon distance [km]		142.6	
elevation [m-ms1]		1135	
elevation angle (deg)			
Location, latitude	48° 56' 49.4"N	49°51'54"N	
longitude	8º12'12.2"E	8° 37' 33"E	
Path vearing			
elevation [m-ms1]		and the second contract of the second contrac	
Other information:			

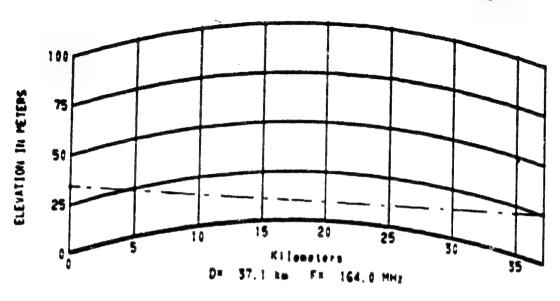
OT/TRER 16, 649. 1.37

Figure 333. Path 12040, parameters.

Path Number:	1 2 4 4	3	
Code Number: 1 1 3 6 1 0			
Location: Hornisgrinde, West Ger	many - Darmstadt,	West Germany	
Data type hourly medians			m-ms l
N _s 289 N-units, a 8314	km. Surface ty	pe average ground	
climate continental temperate	•	de	km
Frequency 6825 MHz, Transmit			dBW
3h 289.1 m, θ mr.			ub#
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1150	165	
gain [dBi], main beam			
height [in], above site surface		39	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		142.6	
elevation (m-msi)		1135	
elevation angle [deg]			
Location, latitude	48° 36' 49.4"N	49°51'54"N	
longitude	8º12'12.2"E	8°37'33"E	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 334. Path 12443, parameters.





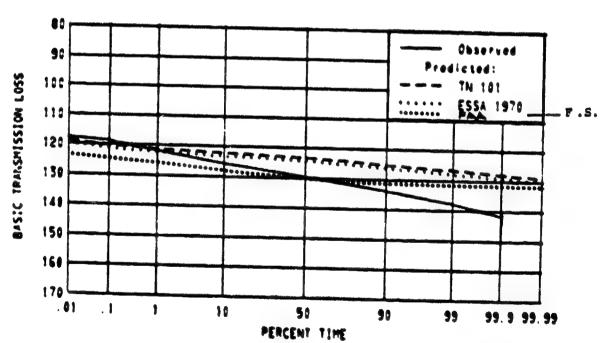


Figure 335. Path 12370, profile and predictions.

Path Number:	1 2 3 7	0	
Code Number: 1 1 2 1 1 0	0 4 5 3 1 1	3 2 1 1	
Location: Mellum Plate. West Ger	many - Bremerhavei	n, West Germany	
Data type 11540 hourly medians	Distance 37.	.1 km.h 0	m-ms1
N _s 312 N-units, a 8676	km, Surface ty	pe sea water	
Climate maritime temperate overs	ea	de	km
Frequency 164 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 0 m, θ mr.			
	Transmitter	Ones i	
Antenna elevation [m-ms1]	34.5	Receiver	
gain [dBi], main beam		25.1	
height [m], above site surface		24.7	
line loss [dB]	*		
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms]]			
elevation angle [deg]			
Location, latitude	53°46'15"N	53°34°20"N	
longitude	8°06'E	8°33'E	
Path bearing			
elevation (m-msl)			
Other information:			

Figure 336. Path 12370, parameters.

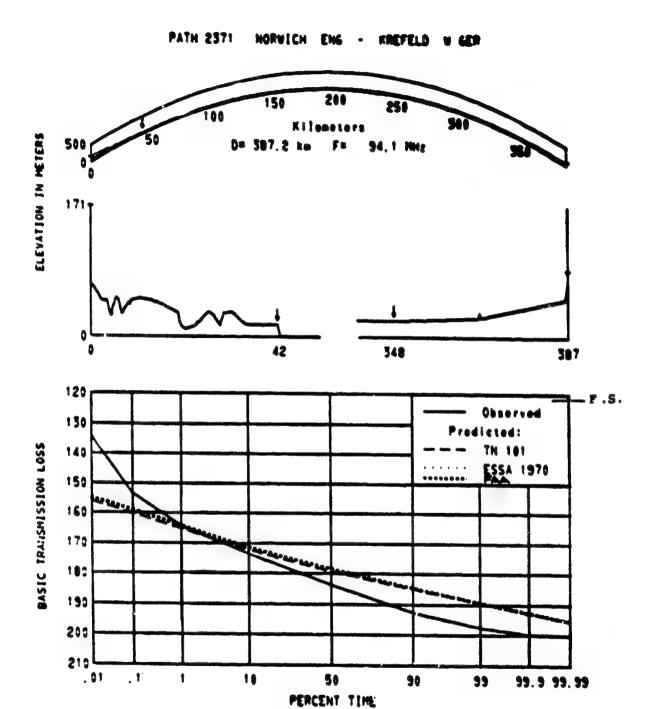
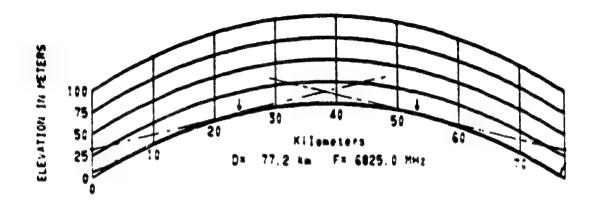


Figure 337. Path 12371, profile and predictions.

Path Number:		Total Control	
Code Number: 1 1 2 0 3 0 0	0 4 5 2 1 1	3 4 1 1	
Location: Norwich, England - Kre			
Data type 14377 hourly medians	, Distance387.	2 km,h 0	m-ms 1
N 317 N-units, a 8766			
Climate continental temperate		de	km
Frequency 94.1 MHz, Transmit	ter output	dBW. EIRP	dBW
th 28.8 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	171	88.7	
gain [dBi], main beam			
height [m], above site surface		19	
line loss [dB]			
polarization	Н	Н	
type			
<u>Morizon</u> distance [km]		38.9	
elevation [m-msl]		21	
elevation angle [deg]			
Location, latitude	52° 31 ' 03"N	51°25'20"N	
longitude	1°08'E	6°28'39"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 338. Path 12371, parameters.



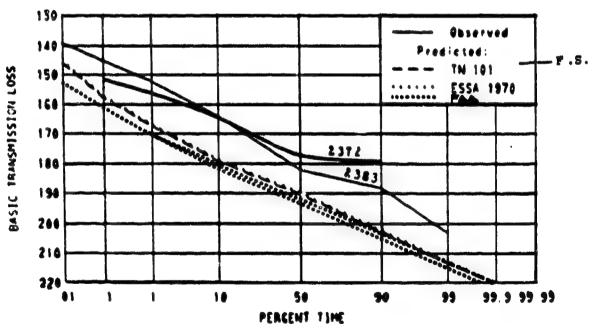


Figure 339. Paths 12372 and 12383, profile and predictions.

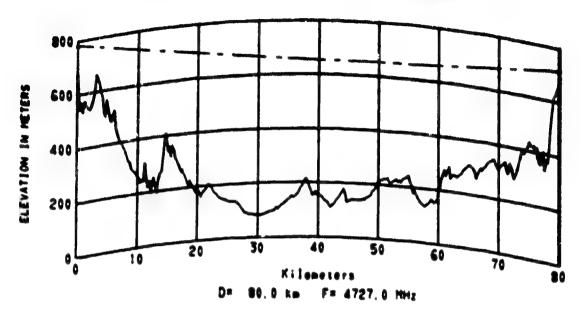
Path Number: Code Number: 1 1 3 6 3 0 0 Location: Weddewarden, West German Data type 976 hourly medians	4 5 3 1 1 wy - Helgoland, W . Distance 77.	3 2 1 1 est Germany 2 km,h	m-ms l
N _s 314 N-units, a 8711	_km, Surface typ	e sea witer	km
Climate maritime temperate overses	1	4011 5100	dBW
Frequency 6825 MHz, Transmitt	er output	dow, EINP	
Δh 0 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	28	30	
gain [dBi], main beam			
height [m], above site surface	22.6		
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	53° 36' 06"N	54°10'47"N	
longitude	8° 32' 06"E	7°53'16"E	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 340. Path 12372, parameters.

Path Number: Code Number: 1 1 3 6 3 0 0 Location: Weddewardem, West German Data type 21165 hourly medians N 314 N-units, a 8711 Climate maritime temperate overse Frequency 6825 MHz, Transmitt	ny - Helgoland, W _, Distance <u>77</u> _km, Surface typ a	3 2 1 1 est Germany 2 km,hrs 0 e sea water de	m-ms 1 km dBW
Δh 0 m, θ mr.			
Antenna elevation [m-msl]	Transmitter 33	Receiver 33'	
gain [d8i], main beam			
height [m], above site surface		16	
line loss [dB]	-		
polarization	н	Н	
type			•
Horizon distance [km]			•
elevation [m-msl]			•
elevation angle [deg]			•
Location, latitude	53°36'06"N	54 ⁰ 10'47"N 7 ⁰ 53'16"E	•
longitude	8°32'06"E	7°53'16"E	
Path bearing			•
elevation [m-msl]			•
Other information:			

Figure 341. Path 12383, parameters.

PATH 2389 FELDBERG/TAUNUS W GER - DONNERSBERG W GER



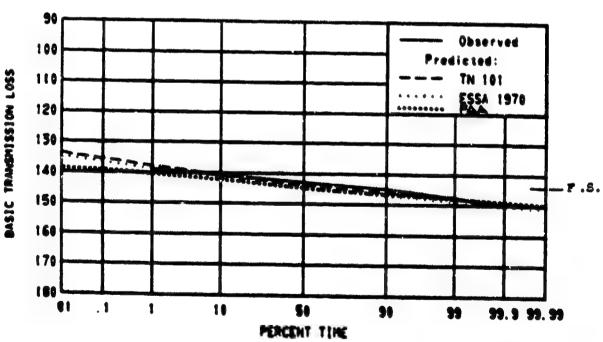
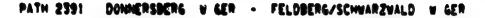
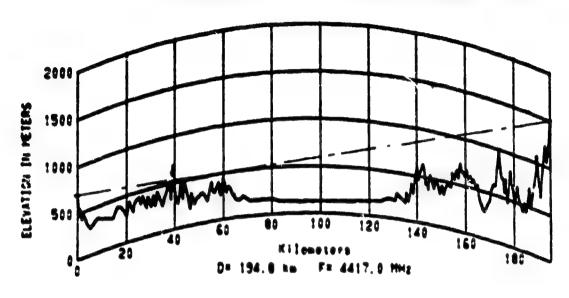


Figure 342. Path 12339, profile and predictions.

Path Number:	_ 1 2 3 8	9	
Code Number: 1 1 3 4 1 0 0	4 5 2 1 1	3 2 1 1	
location: Feldberg/Taunus, West Ge	rmany - Donnersbi	rg, west Germany	
Data type 798 hourly medians	, Distance 80.	0 km, h 250	m-ms 1
N 290 N-units, a 8328	_km, Surface type	e average ground	
Climate continental temperate		de	km
Frequency 4727 MHz, Transmitte	er output	dBW, EIRP	dBW
Δh 419.7 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	781	715	
gain [dBi], main beam			
height [m], above site surface		29	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		76.7	
elevation [m-ms1]		663	
elevation angle [deg]			
Location, latitude	50° 14 ' 32" N	49° 37' 31"N	
longitude	8029147#E	7º55'11"E	
Path bearing			
clevation [m-ms1]			
Other Information:			

Figure 343. Path 12389, parameters.





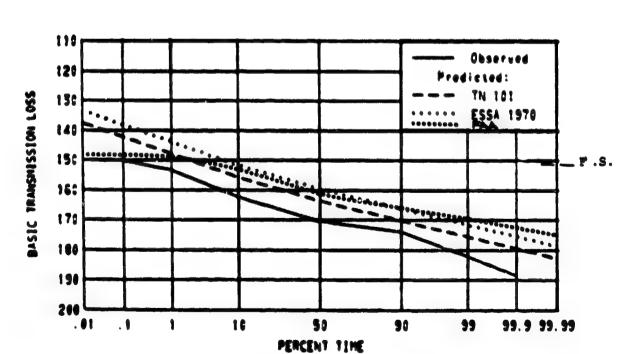


Figure 344. Path 12391, profile and predictions.

Path Number: Code Number: 1 1 3 4 2 2 0 Location: Donnersberg, West German Data type 1264 howrly medians N _S 330 N-units, a 9021 Climate continental temperate Frequency 4417 MHz, Transmitt	y - Feldberg/Schu , Distance 194 _km, Surface typ	warzwald, West Germ .8 km,h 350 e average ground de	2 <i>ny</i> m-ms1 km km
$\Delta h = 426.9$ m, $\theta = mr$.	C. 001711		
Antenna elevation [m-ms1] gain [dBi], main beam height [m], above site surface line loss [dB] polarization type	<u>Transmitter</u> 695.7 10.7	Receiver 1504	
Horizon distance [km] elevation [m-ms1] elevation angle [deg] Location, latitude longitude Path bearing elevation [m-ms1]	39,17 530 49 ⁰ 37'31"N 7 ⁰ 55'11"E	47°52'25"N 8°00'23"E	•

Figure 345. Path 12391, parameters.

PATH 2481 FLENSBURG W GER - NORDERNEY W GER

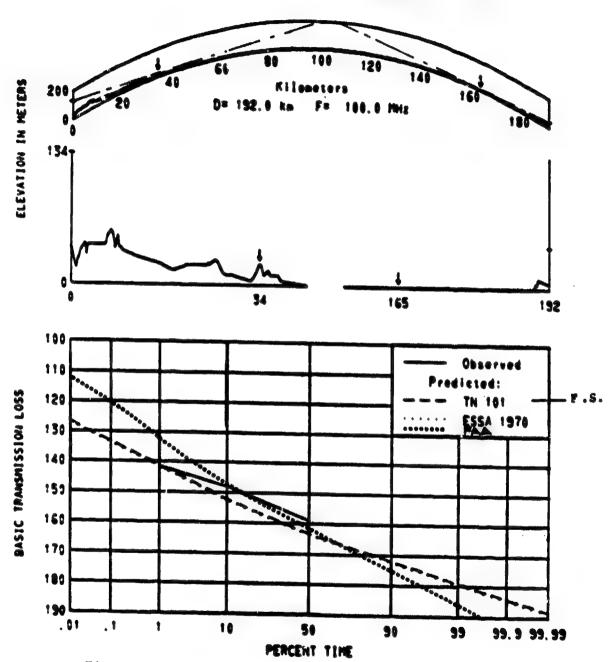


Figure 346. Path 12401, profile and predictions.

Path Number:	1 2 4 0	1	
Code Number: 1 1 2 1 3 0 0	4 5 3 1 1	3 2 1 1	
Location: Flensburg, West Germany	ı - Norderney, Wes	t Germany	
Data type 1437 hourly medians			m-ms l
N ₂ 313 N-units, a 8694	km, Surface typ	e sea water	
Climate navitime temperate overse	ea .	de	km
Frequency 100 MHz, Transmit			dBW
$\Delta h = 0$ m, $\theta = mr$.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	134	43	
gain [dBi], main beam			
height [m], above site surface		38	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]			
elevation [m-msl]			•
elevation angle [deg]			•
Location, latitude	54°47'28"N	53°42'36"N	
longitude	9°27'11"E	7º09'37"E	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 347. Path 12401, parameters.

PATH 2419 WROTHAM ENG - KREFELD W GER

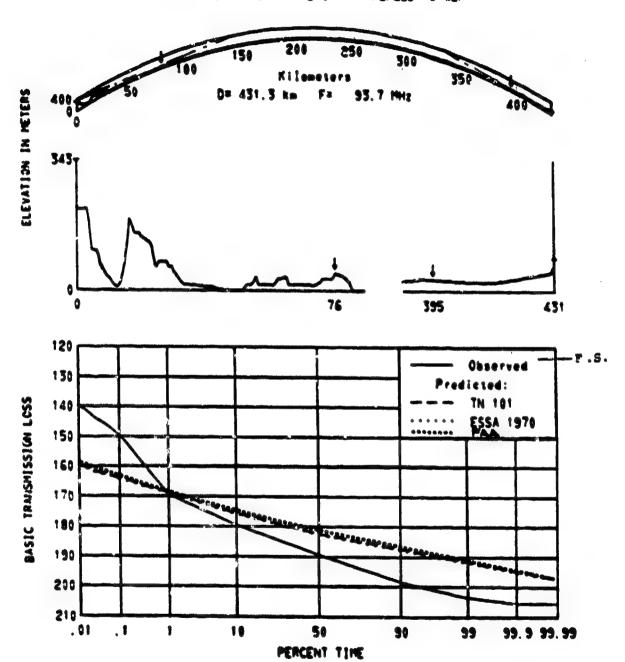
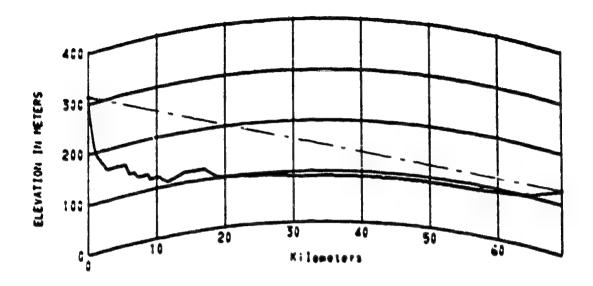


Figure 348. Path 12419, profile and predictions.

Path Number:	1 2 4 1	9	
Code Number: 1 1 2 0 3 0 0	4 5 2 1 1	3 4 1 1	
Location: Wrotham, England - Kref	eld, West Germany		
Data type 7103 hourly medians	, Distance 431	.3 km,h 0	m-ms l
N ₂ 217 N-units, a 8766	km, Surface typ	e average ground	
Climate continental temperate			km
Frequency 93.7 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 39.1 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	343.2	88	
gain [dBi], main beam			
height [m], above site surface		18.3	
line loss [dB]			
polarization	н	<u> </u>	
type			
Horizon distance [km]		35.9	
elevation [m-msl]		30	
elevation angle [deg]			
Location; latitude	51019'11"N	51° 25' 20"N	
longitude	0°17'20"E	6028139"E	
Path bearing			,
elevation [m-ms1]			,
Other information:			

Figure 349. Path 12419, parameters.

PATHS 2444 TO 2446 HAMBACH W GER - DARMSTADT W GER



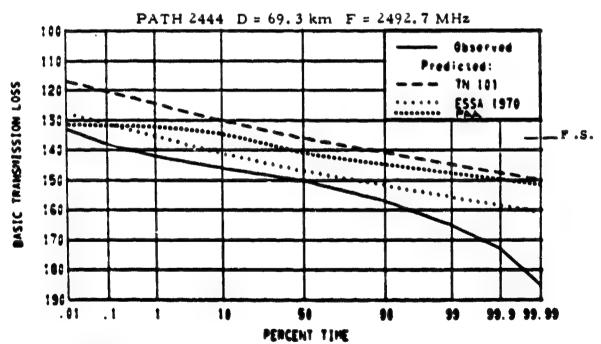


Figure 350. Path 12444, profile and predictions.

Path Number:	1 2 4 4	4	
Code Number: 1 1 3 2 1 0 0	1 4 5 2 1 1	3211	
Location: Hambach, West Germany -			
Data type 30240 hourly medians		.3 km, h 95	m-ms l
N 305 N-units, a \$557	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 2492.7 MHz, Transmit	ter output	dBW, EIRP	dBW
Δh 60.2 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	514	127	
gain [dBi], main beam			
height [m], above site surface			
line loss [dB]			
polarization	н	Н	
type			
Horizon distance [km]		69.3	
elevation [m-ms1]		300	
elevation angle [deg]			
Location, latitude	49°20'03"N	49°51'54"N	
longitude	8007'28"E	8°37'33"E	
Path bearing			
clevation [m-ms1]			
Other information:			

Figure 351. Path 12444, parameters.

HAMBACH W GER - DARMSTADT W GER

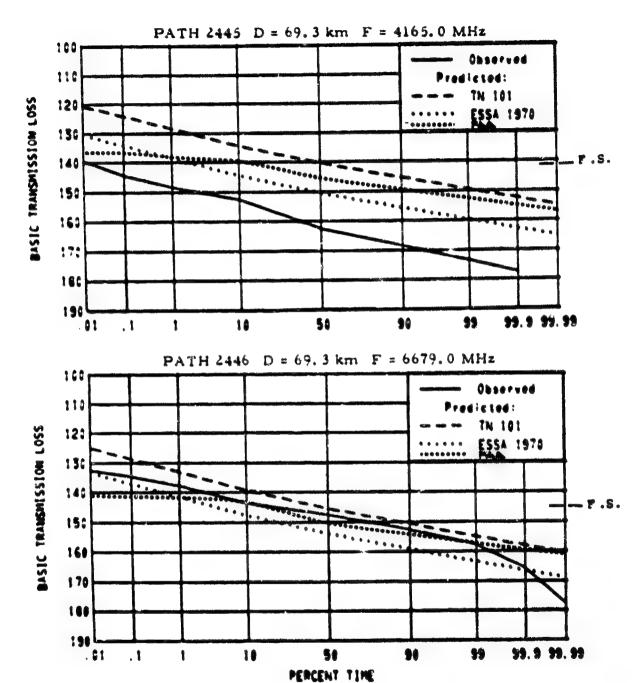


Figure 352. Paths 12445 and 12446, profile and predictions.

Path Number:	1 2 4 4	5	
Code Number: 1 1 3 4 1 0	0 4 5 2 1 1	3 2 1 1	
Location: Hambach, West Germany	- Darmstadt, West	Germany	
Data type 21855 hourly medians	, Distance6	9.3 km,h 95	m-ms l
N _s 305 N-units, a 8557	km, Surface ty	pe average ground	
Climate continental temperate	····	, de	km
Frequency 4165 MHz, Transmi	tter output	dBW, EIRP	dBW
Δh 60.2 m, θ mr	•		
	Transmitter	Receiver	
Antenna elevation [m-ms1]	314	127	
gain [dBi], main beam			
height [m], above site surface		11	
line loss [dB]			
polarization	Н	Н	
type			
Horizon distance [km]		69.3	
elevation [m-msl]		300	
elevation angle [deg]			
Location, latitude	49°20'03"N	49 ⁰ 51'54"N	
longitude	8°07'28"E	8° 37' 33"E	
Path bearing			
elevation [m-msl]			
Other information:			

OT/TRER 16, 6ig. 1.33

Figure 353. Path 12445, parameters.

Path Number:	1 2 4 4	6	
Code Number: 1 1 3 6 1 0 0	4 5 2 1 1	3 2 1 1	
Location: Hambach, West Germany -			
Data type 27714 hourly medians	, Distance 69.	3 km, h 95	m-ms 1
N 305 N-units, a 8557	km, Surface typ	e average ground	
Climate continental temperate		de	km
Frequency 6679 HHz, Transmit	ter output	dBW, EIRP	dBW
Δh 60.2 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]	314	127	
gain [dBi], main beam			
height [m], above site surface		1	
line loss [dB]			
polarization	Н	<u>H</u>	
type			
Horizon distance [km]		69.3	
elevation [m-msl]		300	
elevation angle [deg]			
Location, latitude	49°20'03"N	49°51'54"N	
longitude	8°07'28"E	1037133"E	
Path bearing			
elevation [m-msl]			
Other information:			

OT/TRER 16, 6ig. 1.33

Figure 354. Path 12446, parameters.

4.4 RSMS DATA

In this section predictions made with the IF-77 model and other propagation models of Table 2 (i.e., ESSA 1970, Egli, FCC, Free Space, Longley-Rice with estimated horizon parameters [24, p. 12], and Okumura) are compared with data collected during the summer of 1975 by the ITS Radio Spectrum Measurement System (RSMS). About 167 hours of data taken over six paths are involved (Table 1). The information provided here has not been formally published but is based on material used in an oral presentation titled "San Francisco RSMS propagation data - comparison with predictions," which was given by G. D. Gierhart at the Denver/Boulder Chapter IEEE/AP-S Symposium on May 7, 1976. Path parameters and profiles are shown in Figures 355 through 364 at the end of this section. They are grouped by path number, as shown in the List of Figures.

Table 8 provides received signal level statistics for these paths. Effective heights determined for use with various propagation models are given in Table 9. Table 10 provides the difference, ΔL , between median basic transmission levels predicted via the various models and those observed for all six paths. Here ΔL is calculated using median received power levels as shown in Table 3.

Statistics associated with AL for various model-height combinations are also given in Table 10, and some observations concerning these statistics are as follows:

- (1) If reasonable effective heights are used, all models produce predictions with a AL of 10 dB or less.
- (2) Every model-height combination results in at least one ΔL with a magnitude greater than 10 dB, but three combinations come within 3 dB of measurements made over the only nonline-of-sight path (30003, Fig. 360) in the group.
- (3) Predictions made with the Okumura model always result in free space values, but ranking by $\overline{\Delta L}$

Paths 30001 through 30006 Received Signal Level Statistics (d) Table 8.

Transmitter Acceiver Frequency (Mix.) Medians Hourly(b) Instantaneous (c) Temite Mill Pale Alto 162.4 61 -59 -59 Temite Mill Bernel Mrs. 162.4 19 -72 -73 Sam Fran. Pale Alto 162.55 cl -59 -59 Mr. Dummium Pale Alto 409 33 -93 -93 Medwood City Bernel Mrs. 416.375 33 -69 -69					Beaber	Median Sign	Median Signal Levels (dBa)		Fading Range(a) (dB)
Tenite Mill Pale Alto 162.4 61 -59 -59 Tenite Mill Bernel Mis. 162.5 19 -72 -73 Sam Fran. Pale Alto 162.55 51 -58 -59 Sam Fran. Bernel Mis. 162.55 (d) -67 Mr. Unmakes Pale Alto 489 33 -93 -93 Machood City Bernal Mis. 416.375 33 -69 -69	72.6	Treeseitter	Receiver	Frequency (MHz)	of Hourly Medians	Hourly (b)	Instantaneous (c)	Mourly(b)	fastantaneous (c)
Tendite Mill Dersel Mis. 162.4 19 -72 -73 Sam Fran. Pale Alto 162.55 51 -56 -59 Sam Fran. Dersel Mis. 162.55 (4) -67 Mr. Ummissa Pale Alto 409 35 -93 -69 -69	ē	Tealte Mill	Pale Alto	162.4	19	- 59	85-	•	•
Sam Fran. Palo Alto 162.55 cl -58 -59 Sam Fran. Bernal Mts. 162.55 (d) -67	20005	Testte Mill	Bernel Hts.	162.4	<u>•</u>	.72	-73	•	•
Sam Fram. Dermal Hts. 162.55 (4) -47 Ht. Emunium Pale Alto 409 33 -93 -95 Redwood City Dermal Hts. 416.375 33 -69 -69	30083	See Pres.	Palo Alto	162.55	7,	35.	-55	10	11
Mt. Unumbles Pale Alto 469 35 -93 Redwood City Dermal Mts. 416.375 33 -69	3000	San Præ.	Dermal Hts.	162.55	3	-67	;	;	*
Redwood City Bernel Mts. 416.375 33 -69	X	#. Feet	Pale Alto	:	33	-93	- 93	^	•
	38885	Redwood City	Bernal Hts.	416.375	33	\$	*	~	•

Bifference between signal level encreded 10 percent of the time and that enceeded 90 percent of the time.

(b) Based on cumulative distributions of bourly medians.

Based on camplative distributions of instantaneous levels.

ld) Based on spet measurements, signal level exceeded the top (.53 dBs) of the RBMS calibration table during normal measurements. Special measurements with additional attenuation were made to obtain values for high signal levels.

Table 9. Paths 30001 through 30006 Effective Antenna Heights (Meters)

	30001	30002	30003	30004	30005	30006
			Transi	nitter		
GMF (a)	10.7	10.7	16.8	16.8	9.1	4.6
GROUND (b)	12.2	12.2	16.8	16.8	9.1	4.6
ESSA 70 ^(c)	822	1013.6	24.7	566.2	805.7	4.6
EGLI (d)	722	739.7	481.7	500	722	
FCC ^(d)	722	739.7	481.7	500	722	
IF-77 ^(e)	873	1018	16.8	578	873	4.6
LONGLEY-RICE (f)	21.9	21.5	26.2	25.9	18.9	13.6
	•••••		Rece	iver		
GROUND (a)	10.7	10.7	10.7	10.7	10.7	10.7
ESSA 70 ^(b)	10.7	117.5	10.7	85.3	10.7	128.8
EGLI (g)	10.7	10.7	10.7	10.7	10.7	10.7
FCC ^(h)	10	10	10	10	10	10
IF-77 ^(e)	10.7	157	40.5	103.1	10.7	154.3
LONGLEY-RICE (f)	20.4	20.1	20.3	20.1	20.4	17.8

⁽a) Height above site surface given in the Government Master File (GMF) of frequency assignments.

⁽b) Actual height above site surface as obtained from station operating personnel.

⁽c) Obtained by a statistical analysis of terrain data that is a part of the computer program used for the ESSA 1970 predictions (Telecommunications analysis services reference guide, an informal OT/ITS document).

⁽d) Height above average terrain that is along the profile 2 to 10~mi (3 to 16~km). An effective transmitting antenna height for path 30006 is not available since the antenna is below the average terrain (Fig. 364).

⁽e) Estimated from observation of path profiles.

⁽f) Estimated from the terrain parameter Δh using the siting option for maximum effective heights [24, p. 11].

⁽g) Taken as height above ground for the receiving antenna.

⁽h) Maximum receiving antenna height for which model curves are applicable.

Paths 30001 through 30006 AL Statistics Table 10.

				3	(187)					
Pade (e)	Refoceive Meights (f)	30001	30002	30003	30004	30005	30006	(49)	°AL (c.)	(2) (4) (4)
1F. 97. V(E)	744	*	2.	.3	7	-	-19	1-	•	11
18.77.1(1)	FAA	•	7	÷	۶	-	-10	~	8	-10
100 E	144	:	~-	N	S -	-	^	~	٠	:
ESSA 1970	ESSA 1976(A)	~	•	₽n,	-	-	~	•	v	12
ESSA 1970	FAA	12	•	•	-		-2	•	s	12
ED.	ECLI	~	13	-15		~	S	•	:	-15
ğ	FCC	21	**	÷.	•	•	3	•	15	97
OCCUPANTA	FCC	•	~	- 30	٠,		3	•	٠	70
ESSA 1970	ECLI	22	•:	•	•	#	3	7	*	12
PRET SPACE	Not Used	•	~	-30	'n		-12	-	•	-2¢
ESSA 1978	**	•	.,	-13	•	•2•	-7	•	91	-26
LONGLET-RICE	744	32	~	13	•	22	~	:	•	32
LONGLEY-RICE	101	*	52	•	13	Se	*	11	15	z
LONGLETY-RICE	LONGLEY-RICE	~	22	=	22	•	~	26	17	42
175	CADDING	=	•	=	*	2	25	*	13	Ş

Difference between predicted and observed median basic transmission loss (Table 3). 38

ole standard devistion of AL.

The At value (sign included) corresponding to the maximum absolute value of AL encountered. 2 E E

Model-effective height combinations are ordered by their ability to provide good prodictions for these paths with the "boot" prodicter listed first. Here, ordering is based on AL, and MAX[AL], respectively. We consideration in

given to the values of other parameters once a difference large enough to establish a relative rank is obvious.

be Table 9. E

Predictions were made via the 19-77 model for both the variability (-Y) and lobing (-L) options (Table 4), [21, Sec. 3

Values of AL for path 30005 were used to rest this predictor with the one following it. 3

- caused it to be rated above the Free Space model. The lower $\overline{\Delta L}$ was obtained because the height above average terrain problem (Table 9) prevented the use of the Okumura model for path 30006.
- (4) Free Space is the simplest model to use and is a part of most other models. It just happens to provide reasonable estimates on the average for the mostly (5 of 6) line-of-sight paths considered in this section. But it can result in large errors for nonline-of-sight paths; e.g., ΔL for path 30003 is -20 dB.
- (5) The poor performance of the Longley-Rice area mode model and the Egli model with heights above ground is not surprising since they are really not applicable to paths of this type (Table 2).
- The ESSA 1970 GMF predictions were performed (6) using unaltered data from the Government Master File (GMF) of frequency assignments (except where the GMF frequency did not correspond to the frequency in use) and the master terrain data file. This means that both equipment and terrain parameters differ for this prediction set: o.g., antenna gain differences as much as 24 dB occurred. For other predictions, terrain information obtained from our master terrain data file was supplemented with data obtained from 7.5 minute topographic maps. Despite these handicaps, the ESSA 1970 GMF combination was not the worst performer, and the magnitude of XI was only 8 dB. However, the Free Space model was ranked above it so that the use of accurate equipment parameters is an important part of the prediction process.

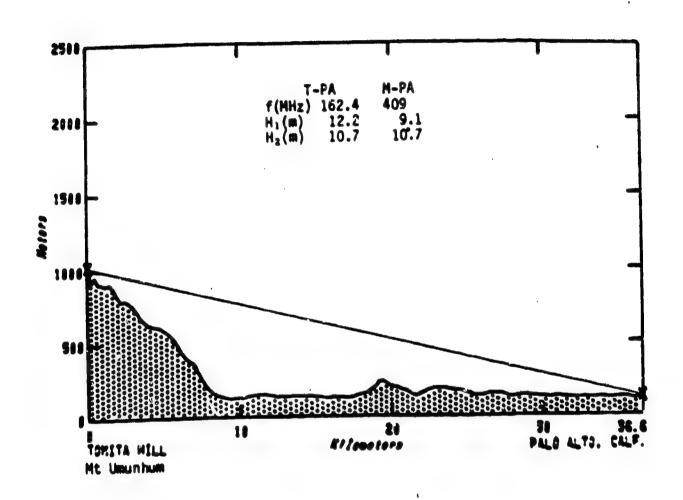


Figure 355. Paths 30001 and 30005, profile, Tomita Hill to Palo Alto and Mt. Umunhum to Palo Alto.

Path Number:	3 0 0 0	1	
Code Number: 1 1 2 1 1 0 0	4 5 2 0 1	2 5 0 1	
Location: Tomita Hill, California	ı - Palo Alto, Cal	ifornia	
Data type signal levels	, Distance <u>36</u>	.6 km, h	m-ms l
N _o 330 N-units, a_	km, Surface typ	e average ground	
Climate maritime temperate overla	and	de	km
Frequency 162 MHz, Transmit	ter output 24.4	dBW, EIRP	dBW
Δh 637 m, θ mr.			
Antenna elevation [m-msl]	Transmitter 1018	Receiver 755.5	
gain [dBi], main beam	-6	2	
height [m], above site surface	12.2	10.7	
line loss (dB)	1	3.5	
polarization	V	V	
type		**************************************	
<u>Horizon</u> distance [km]			
elevation (m-ms1)			
elévation angle [deg]			,
Location, latitude	37°09'38"N	37°24' 34"N	
longitude	121° 54' 25"W	122 ⁰ 10'42"W	,
Path bearing			•
elevation [m-msl]			•
Other information:			

Figure 356. Path 30001, parameters.

Path Number:	3000	5	
Code Number: 1 1 2 1 1 0			
Location: Mt. Umunhum, California			
Data type signal levels			m-ms 1
N 330 N-units, a			
Climate maritime temperate overl			lun
Frequency 409 MHz, Transmit			dBV
Δh 637 m, 0 mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1018	155.5	
gain [dBi], main beam	-6	2	'
height [m], above site surface	12.2	10.7	ı
line loss [dB]	1	3.5	
polarization	V	V	
type			
<u>Horizon</u> distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	37°09'38"N	37°24'34"N	
longitude	121°54'25"W	122°10'42"W	
Path bearing			
elevation [m-msl]			
Other information:			

Figure 357. Path 30005, parameters.

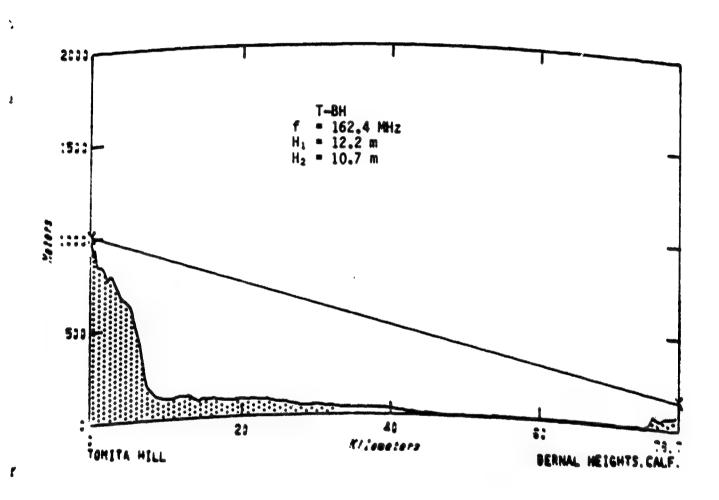


Figure 358. Path 30002, profile, Tomita Hill to Bernal Heights.

Path Number:			
Code Number: 1 1 2 1 1 0 0	4 5 2 0 1	2 5 0 1	
Location: Tomita Hill, California			
Data type <u>signal levels</u>		7km,h_s	m-ms l
N 330 N-units, a	km, Surface typ	e average ground	
Climate maritime temperate overla			km
Frequency 162.4 MHz, Transmit	ter output 24.4	dBW, EIRP	dBW
$\Delta h \underline{353} m_{\bullet} \theta \underline{} mr_{\bullet}$			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	1018	157	
gain [dBi], main beam	-6	2	
height [m], above site surface	12.2	10.7	
line loss [dB]	1	4,5	
polarization	v	V	
type			
Horizon distance [km]			
elevation [m-ms1]			
elevation angle [deg]			
Location, latitude	37°09'38"N	37°44'35"N	
longitude	121°54'25"W	122°24'50"W	
Path bearing			
elevation [m-ms1]			
Other information:			

Figure 359. Path 30002, parameters.

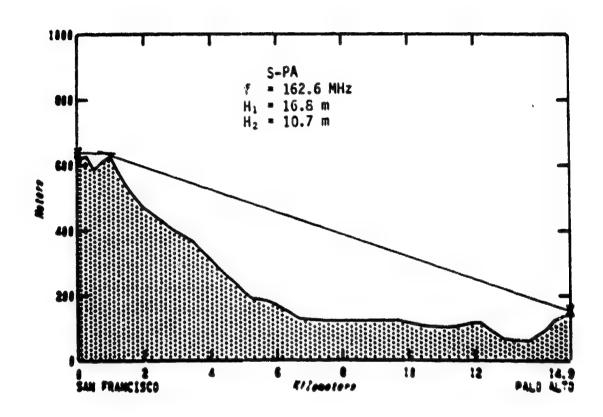


Figure 360. Path 30003, profile, San Francisco to Palo Alto.

Path Number:			
Code Number: 1 1 2 1 2 1 0			
Location: San Francisco, Californ	ia - Palo Alto, Co	rlifornia	
Data type <u>signal levels</u>	, Distance1	1,9 km,h	m-ms 1
N _O 330 N-units, a	km, Surface typ	e average ground	
Climate maritime temperate overla	nd	de	km
Frequency 162.55 MHz, Transmitt			dBW
Δh 598 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	638	155.5	
gain (dBi), main beam	10	2	
height [m], above site surface	16.8	10.7	
line loss [dB]	1	3,5	
polarization	v		
type			
Horizon distance [km]		13.9	
elevation [m-ms1]		633	
elevation angle [deg]			
Location, latitude	37° 27' 02"N	37°24'34"N	
longitude	1220 20 11 "W	122°10'42"W	
Path bearing			
elevation [m-msl]		manipulpulpur manipurdingininginingin andress 4 Maintigations	
Other information:			

Figure 361. Path 30003, narameters.

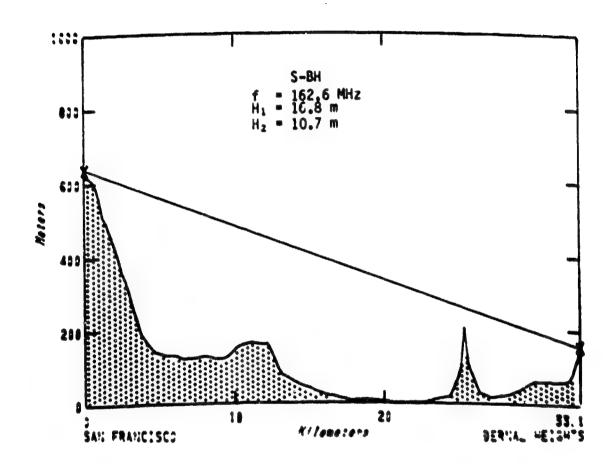


Figure 362. Path 30004, profile, San Francisco to Bernal Heights.

Path Number:	3 0 0 0	4	
Code Number: 1 1 2 1 1 0 0	4 5 2 0 1	2 5 0 1	
Location: San Francisco, Californ	ia - Bernal Height	s, California	
Data type signal levels	, Distance 33.1	km, h	m-ms l
N 330 N-units, a	km, Surface type	average ground	
Climate maritime temperate overla	nd .	de	km
Frequency 162.55 MHz, Transmitt	er output 24.4	dBW, EIRP	dBW
Δh 359 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	638	157	
gain [dBi], main beam	14	2	
height [m], above site surface	16.8	10.7	
line loss (dB)	11	4.5	
polarization	V	V	
type			
<u>Horizon</u> distance [km]		7.6	
elevation [m-msl]		205	
elevation angle [deg]			
Location, latitude	37° 27' 02"N	37°44'35"N	
long i t ude	122° 20' 18"W	122°24'50"W	
Path bearing			
elevation [m-ms1]		1	
Other information:			

Figure 363. Path 30004, parameters.

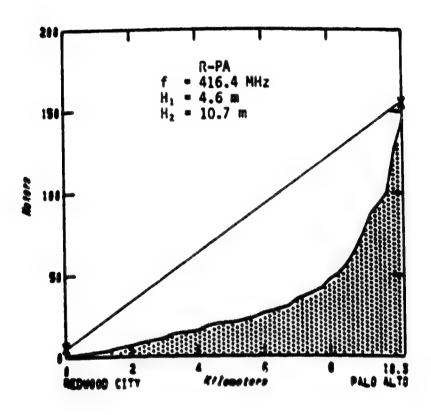


Figure 364. Path 30006, profile, Redwood City to Palo Alto.

Path Number:	3 0 0 0	<u>6</u>	
Code Number: 1 1 2 4 1 0 0	4 5 2 0 1	2 5 0 1	
Location: Redwood City, Californi	a - Palo Alto, Cal	ifornia	
Data type signal levels	, Distance 10.	3 km, h	m-ms 1
N _o 330 N-units, a			
Climate maritime temperate overla		·	km
Frequency 416.4 MHz, Transmitt			dBW
Δh 99 m, θ mr.			
	Transmitter	Receiver	
Antenna elevation [m-ms1]	5.8	155.5	_
gain [dBi], main beam	7	2 *	
height [m], above site surface	4.6	10.7	•
line loss [dB]	3	1.5	•
polarization	v	V	•
type			
Horizon distance [km]			•
elevation [m-msl]			•
elevation angle [deg]			•
Location, latitude	37°29'33.5"N	37024134NN	•
longitude	122 ^p 13'45"W	122°10'42"W	•
.Path bearing			•
elevation [m-msi]			•
Other information:			•

Figure 365. Path 30006, parameters.

5. ACKNOWLEDGMENTS

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Reference: Longley, A. G., R. K. Reasoner, and V. L. Fuller (1971), Measured and predicted long-term distributions of tropospheric transmission loss, OT Telecomm. Res. and Eng. Rept. OT/TRER 16 (NTIS, COM-75-11205).

Abstract: This report summarizes measurements of tropospheric transmission loss and its long-term variability for nearly 800 paths in various parts of the world. The measurements were made at frequencies from 40 MHz to 10 GHz over distances which range from 10 to 1000 km. Terrain profiles and cumulative distributions of both observed and predicted losses are plotted for more than 500 of these paths. A preliminary analysis of differences between observed and predicted values is included.

Key Words: Cumulative distributions, location variability, longterm variability, measurements, predictions, tropospheric propagation.

Remarks: This source contains approximately 2.89 million hours of data of which about 866,000 hours are associated with the paths used in this report.

Figure Al. Source 1 information sheet.

APPENDIX A. AERONAUTICAL PROPAGATION DATA POOL

To aid in the validation and improvement of propagation models such as the IF-77 model, NTIA/ITS has started to pool data relevant to tropospheric radio propagation over aeronautical type propagation paths; i.e., paths such as air/ground, air/air, ground/satellite, and point-to-point paths where at least one antenna is high enough so that terrain is not an important consideration or is only an important consideration for one terminal. This data pool may be considered as an extension of the tropospheric radio propagation data pool [26] to include aeronautical paths.

Data source documents are retained at NTIA/ITS, and data are extracted from them as required. Information concerning the sources of the data used in this report are provided in Saution A.1.

To aid in managing the data, a path number and a code number are assigned to each path. These are discussed in Section A.2.

Path parameters are tabulated on a parameter sheet to allow ready access to path parameter information. The form used for this purpose is the form used to provide such information throughout the main text of this report. However, an item-by-item discussion of the form is provided in Section A.3.

A.1 SOURCE INFORMATION

I

Information on source documents for data assigned to the aeronautical propagation data pool is summarized on source information sheets. The information contained on such sheets consists of the source number, document reference, abstract, key words, and other remarks that may be appropriate. Source sheets for the data sources associated with the data used in Section 4 are provided in Figures Al through A4.

Reference: Gierhart, G. D., A. P. Barsis, M. E. Johnson, E. M. Gray, and F. M. Capps (1971), Analysis of air-ground radio wave propagation measurements at 800 MHz, OT Telecomm. Res. and Eng. Rept. OT/TRER 21 (NTIS, COM-75-10830/AS).

Abstract: An analysis is presented of air-ground radio wave propagation measurements, which were performed using an airborne transmission source at approximately 6400 m above msl. Receiving antennas were slightly within and beyond line-of-sight of the airborne transmitters. Received signal level data were obtained on 823.75 MHz and 847.75 MHz. Data were analyzed for short-term and long-term statistics of basic transmission loss. Long-term fading range statistics were compared with values calculated using a modified longley-Rice model and good (~ 1 percent) agreement was obtained. This model appears to underestimate the long-term median transmission loss by about 3 dB.

Key words: Air-ground communications, transmission loss, tropospheric propagation, MPATI (Midwest Program on Airborne Television Instruction).

Remarks: This source contains approximately 4130 hours of measured data.

Figure A2. Source 2 information sheet.

Reference: Gierhart, G. D. (1976), San Francisco RSMS propagation data--comparisons with predictions, informal oral presentation given during the Denver/Boulder Chapter IEEE/AP-S Symposium on May 7, 1976.

Abstract: During the summer of 1975, the OT/ITS Radio Spectrum Measurement System (RSMS) was deployed for the OTP in the San Francisco area to collect usage data on Federal VHF/UHF Land Mobile Radio (LMR). Signal level statistics for six "base-to-base" type paths were developed and compared with predictions made via several models. Best agreement was obtained with the IF-77 model, but the simple free space model provided good estimates for the five line-of-sight paths.

Kev Words: Land mobile radio (LMR), radio spectrum measurement system (RSMS), radio wave propagation.

Remarks: This source contains approximately 167 hours of measured data.

Figure A3. Source 3 information sheet.

Reference: Everhart, R. E. (1975), Airborne measurements of VOR/Localizer signal strength and desired-to-undesired signal ratios, DOT Rept. FAA-RD-75-165, I (NTIS; ADA 030502).

Abstract: This report contains the results of airborne tests to obtain VHF Navaid signal strength measurements and also facility flyability recordings with two different Localizer and VOR Facility spacings. The tests were conducted with the VOR and Localizer transmitters on adjacent channels. The data presented are measurements of the signal strengths of the facilities examined as well as crosspointer deviation and flag currents.

Volume I - VOR and Localizer Free Space Interactions, Chickasha, Oklahoma.

Key Words: VOR, localizer, field strength signal ratios, spectrum management.

Remarks:

- (1) The VOR and ILS localizer signals were measured and recorded simultaneously.
- (2) D/U ratios are plotted for simultaneous measurements. This source contains approximately 20 hours of measured data.

Figure A4. Source 4 information sheet.

A.2 PATH AND CODE NUMBERS

To aid in the managing of the data and path numbers, a path code number is assigned to each path that is associated with data in the aeronautical propagation data pool.

Path numbers are in two parts where the portion of the number to the left of the fourth place is the source number (Sec. 4.1). The four right-hand numbers are the path numbers used within the source document or are somewhat arbitrarily assigned to the paths considered in the document, usually by order of occurrence. For example, in 10031, 1 is the source number and 31 is the path number assigned to this path in the source document (Fig. 42).

Code numbers are used to characterize paths (or documents) so that sorting to obtain paths with particular characteristics can easily be accomplished. Two digits of the 16 digit code number are used for each of eight categories as illustrated in Figure A5. Code numbers within each category are defined in Tables A1 through A8, where each figure relates to a different category. Note that many numbers are currently undefined so that growth can be accommodated.

SAMPLE CODE NUMBER

DIGITS	<u> </u>	0 4	5 2 1 1 0 7 3 1
DIGITS	CATEGORY	TABLE	TRANSLATION
1 & 2	Data	A1	02: Propagation data
3 & 4	Frequency	A2	14: VHF (30 to 300 MHz)
5 4 6	Propagation	A3	30: Forward scatter-general
7 & 8	Path	A4	04: Point-to-point
9 & 10	Topical	A5	52: Irregular terrain
11 & 12	Variability	A6	11: Hourly median
13 & 14	Location	A7	07: Middle latitude
15 & 16	Source	AS	31: Technical journal

Figure A5. Code number categories.

Table Al. Path Code Number, Content

- 01 Propagation theory
- 02 Propagation data
- 03 Both of above
- 04 Meteorological theory
- 05 Meteorological data
- 06 Both of above
- 07 Terrain theory
- 08 Terrain data
- C9 Both of above
- 10 Predictions
- 11 Data and prediction
- 12 D/U ratios

Table A2. Path Code Number, Frequency

01	General	39 9 to 10 GHz
10	VLF (to 30 kHz)	41 10 to 20 GHz
11	LF (30 to 300 kHz)	42 20 to 30 GHz
12	MF (300 to 3000 kHz)	
13	HF (3 to 30 MHz)	44 40 to 50 GHz
14	VHF (30 to 300 MHz)	
15	UHF (300 to 3000 MHz)	
16	SHF (3 to 30 GHz)	47 70 to 80 GHz
17	EHF (30 to 300 GHz)	48 80 to 90 GHz
18	Over 300 GHz	49 90 to 100 GHz
19	Microwave	
20	20 to >100 MHz	51 100 to 200 GHz
21	100 to 200 MHz	52 200 to 300 GHz
22	200 to 300 MHz	53 300 to 400 GHz
23	300 to 400 MHz	54 400 to 500 GHz
24	400 to 500 MHz	55 500 to 600 GHz
25	500 to 600 MHz	56 600 to 700 GHz
26	600 to 700 MHz	57 700 to 800 GHz
27	700 to 800 MHz	58 800 to 900 GHz
28	800 to 900 MHz	59 900 to 1000 GHz
29	900 to 1000 MHz	60 Over 1000 GHz
31	1 to 2 GHz	
32	2 to 3 GHz	
33	3 to 4 GHz	
34	4 to 5 GHz	
35	S to 6 GHz	
36	6 to 7 GHz	
37	7 to 8 GHz	
38	8 to 9 GHz	

Table A3. Path Code Number, Propagation

- 01 General
- 10 Line-of-sight
- 20 General diffraction
- 21 Single knife edge
- 22 Rounded knife edge
- 23 Rounded earth
- 24 Double knife edge
- 25 Multiple knife edge
- 30 Forward scatter-general

Table A4. Path Code Number, Path

- 01 General
- 02 Area (prediction)
- 03 Broadcast
- 04 Point-to-point
- 05 Ground to air
- 06 Air to ground
- 07 Air to air
- 08 Ground to satellite
- 09 Air to satellite
- 10 Satellite to satellite

Table A5. Path Code Number, Topical

01	General	72	VOR
•		73	VORTAC
10	Equipment-general	74	TACAN
11	Antennas	75	MLS
		76	Glide slope
20	Reflection coefficient		
21	Divergence		
22			
23	Multipath		
24	Folding		
30	Meteorology-general		
31	Climates		
32	Ray bending		
33	Atmospheric absorption		
35	Rain attenuation		
40	Ionospheric scintillation		
50	Terrain-general		
51	Smooth earth		
52	Irregular terrain		
5 3	Sea state		
55	Buildings		
56	Foliage		
59	Surface constants		

70 Nav aids

71 ILS localizer

Table A6. Path Code Number, Variability

- 01 General
- 10 Long term
- 11 Hourly medians
- 2.0 Short term
- 30 Location variability

Table A7. Path Code Number, Location

			A 1
01	General	40	Asia
02	N Hemisphere	41	
03	S Hemisphere	42	•
04	Artic	43	•
05	Antartic	44	
06	Equatorial	45	Japan
07	Middle latitude		
		50	Australia
11	Mountains		
12	Plains	60	Canada
13	Sea coast	61	East Coast
14	Sea	62	Hudson Bay
		6.3	Great Lakes
20	United States	64	Central Plain
21	NE Sea Board	65	West Coast
22	SE Sea Board	66	Yukon
23	Gulf Coast	67	Northeast
24	Great Lakes		
25	South Pacific Coast		
26	NW Coast		
27	Rocky Mountains		
28	Central Plains		
30	Europe		
31	British Isles		
32	Germany		
33	Mediterranean		
34	English Channel		
35	•		
36			
	·		

37 Italy

Table A8. Path Code Number, Source

- 01 Informal talk
- 02 Private letter
- 03 Working papers
- 10 Technical memorandum
- 11 Technical report
- 12 Monograph
- 13 Unpublished report
- 21 Paper presented at conference
- 22 CCIR documents
- 23 ICAO documents
- 31 Technical journal
- 32 Scientific magazine
- 33 General magazine
- 41 Book
- 42 Encyclopedia
- 43 Atlas

A.3 PATH PARAMETERS

Path parameter sheets have been used previously in this report; e.g., Figure 1. They provide information on the path, much of which is useful in making propagation predictions. A sample parameter sheet form is shown in Figure A6. A short discussion of each parameter sheet item is provided in the remainder of this section. These discussions are ordered as their subject items are ordered in Figure A6.

PATH NUMBER. This is a unique number assigned to each path (Sec. A.2).

CODE NUMBER. This is a code number used to characterize the path (Sec. A.2).

LOCATION. This is the name(s) associated with the transmitter and receiver location such as a city.

DATA TYPE. This is a brief characterization of the kind of data such as "hourly median variability of received power" or "instantaneous voltage across receiver input versus path length."

DISTANCE. this is the great circle distance between the transmitting and receiving antennas. It is often used as an independent variable in graphs associated with the IF-77 model and is required in such cases to relate propagation predictions to measured data.

 \underline{h}_{rs} . This is the effective reflecting plane elevation above msl. It is related to an optional input parameter (Table 4) of the IF-77 model [21, Sec. 4.1, EFFECTIVE REFLECTION SURFACE ELEVATION discussion].

 \underline{N}_s or N_o . Surface refractivity or surface refractivity referred to sea level are optional input parameters (Table 4) of the IF-77 model [21, Sec. 4.1, REFRACTIVITY discussion].

Path Number:		-	
Code Number:			
Location:			
Data type	, Distance	km, h	m-ms l
N N-units, a			
Climate		4	km
Frequency MHz, Transmit	ter output	dBW, EIRP	dev
Δhm, θmr.			
	Transmitter	Receiver	
Antenna elevation [m-msl]			•
gain [dBi], main beam			•
height [m], above site surface			
line loss [dB]			
polarization			
type			
Horizon distance [km]			
elevation [m-ms1]			•
elevation angle [deg]			
Location, latitude			•
longitude			•
Path bearing			•
elevation [m-ms1]		·	•
Other information:			•
OLNET INTOIMELION:			

Figure A6. Sample parameter sheet.

a. Effective earth radius is an optional input parameter (Table 4) of the IF-77 model [21, Sec. 4.1, REFRACTIVITY discussion].

SURFACE TYPE. This is the type of surface (e.g., average ground, sea water, etc.) that characterizes the portion of the earth's surface from which surface reflection may occur. It is an optional parameter (Table 4) of the IF-77 model [21, Sec. 4.1, SURFACE TYPE OPTIONS discussion].

CLIMATE. This is the climate type (e.g., continental temperate, maritime oversea, etc.) most applicable to the path. It is an optional input parameter (Table 4) for the IF-77 model [21, Sec. 4.1, TIME AVAILABILITY CLIMATES OR TIME BLOCKS discussion].

de. Effective distance as computed by the IF-77 model [16, Sec. 4.3, CLIMATES discussion].

FREQUENCY. Radio frequency is a primary input parameter (Table 4) of the IF-77 model [21, Sec. 4.1, FREQUENCY discussion].

TRANSMITTER OUTPUT. Transmitter output power may be used to determine the EIRP of the transmitting antenna, but is not an input parameter to the IF-77 model.

EIRP. Equivalent isotropically radiated power is the power radiated from the transmitter increased by the antenna's main beam gain. It is an optional input parameter (Table 4) for the IF-77 model [21, Sec. 4.1, EIRP discussion].

Δh. The terrain parameter developed by Longley-Rice [24, Sec. 2-2] is an optional input parameter (Table 4) of the IF-77 model [21, Sec. 4.1, TERRAIN PARAMETER discussion].

THETA. This is the angle between radio horizon rays in the great circle plane defined by antenna locations [33, Sec. 6]. This angle is sometimes called "angular distance," "scatter angle," "diffraction angle," or just "theta." It is a key parameter in propagation via forward scatter and diffraction and is sometimes used to characterize data collected over such paths. Values for theta are calculated within the IF-77 model from path geometry.

ANTENNA ELEVATION. These are the elevations of the transmitting and receiving antennas above mean-sealevel (msl). They are primary input parameters (Table 4) of the IF-77 model [21, Sec. 4.1, AIRCRAFT (OR HIGHER) ANTENNA and FACILITY (OR LOWER) ANTENNA HEIGHT discussions].

ANTENNA GAIN [dBi], MAIN BEAM. These are the main beam antenna gains. They are optional input parameters (Table 4) to the IF-77 model [21, Sec. 4.1, GAIN, RECEIVING ANTENNA discussions].

ANTENNA HEIGHT ABOVE SITE SURFACE. These are the elevations of the earth's surface just below the transmitting and receiving antenna. They are related to an optional input parameter (Table 4) of the IF-77 model [21, Sec. 4.1, TERRAIN ELEVATION discussion].

ANTENNA LINE LOSS. Line losses are used to obtain transmitting antenna input power from transmitter output power or receiver input power from receiving antenna output power. Here line loss is taken to mean all losses associated with the transmission line between the transmitter and transmitting antenna or the receiving antenna and receiver.

ANTENNA POLARIZATION. Polarization is an optional input parameter (Table 4) of the IF-77 model [21, Sec. 4.1, FACILITY ANTENNA POLARIZATION OPTIONS discussion].

ANTENNA TYPE. This is a brief note concerning the kinds of antennas used at the transmitter and receiver (e.g., dipole, dish, etc.). Some specific antenna type options (Table 4) are available in the IF-77 model [21, Sec. 4.1, FACILITY ANTENNA TYPE OPTIONS discussion]. Other types of antennas are handled if the vertical patterns are known.

HORIZON DISTANCE. These are antenna-to-radio-horizon distances. They are related to an optional input parameter (Table 4) of the IF-77 model [21, Sec. 4.1, HORIZON OBSTACLE DISTANCE from FACILITY discussion].

HORIZON ELEVATION. These are radio horizon elevations for the transmitter and receiver. They are related to an optional input parameter (Table 4) for the IF-77 model [21, Sec. 4.1, HORIZON OBSTACLE HEIGHT discussion].

HORIZON ELEVATION ANGLE. These are the radio horizon elevation angles at the transmitter and receiver. They are related to an optional input (Table 4) parameter of the IF-77 model [20, Sec. 4.1, HORIZON OBSTACLE ELEVATION ANGLE ABOVE HORIZONTAL AT FACILITY discussion].

LOCATION LATITUDE, LONGITUDE. These provide transmitter and receiver locations.

<u>PATH BEARING</u>. The bearing of the transmitter site from the receiving site is listed under transmitter bearing and vice versa.

PATH ELEVATION. These are the path (terrain) elevations at the transmitting and receiving sites.

OTHER INFORMATION. Any other information that is pertinent to the path (or data) may be listed here; i.e., the source of the information.

APPENDIX B. ABBREVIATIONS, ACRONYMS, AND SYMBOLS

This list includes most of the abbreviations, acronyms, and symbols used in this report. Many are similar to those previously used in other reports [15, 16, 20].

In the following list, the English alphabet precedes the Greek alphabet, letters precede numbers, and lower-case letters precede upper-case letters. Miscellaneous symbols and notations are given after the alphabetical items.

a	Effective earth radius [5, Eq. 20].
ADUDD	A program name [21, Table 1].
ARD	Aviation Research and Development.
ATOA	A program name [21, Table 1].
A/C	Aircraft.
CCIR	International Radio Consultative Committee.
dB	Decibels, 10 log (dimensionless ratio of powers).
dBi	Antenna gain in decibels greater than isotropic.
dPm	Power in decibels greater than 1 milliwatt.
dBW	Power in decibels greater than 1 watt.
d _e	Effective distance [15, Eq. 177].
d _o	The largest distance in the line-of-sight region at which diffraction effects associated with terrain are considered negligible [16, Eq. 61].
DME	Distance Measuring Equipment.
DOC	United States Department of Commerce.
DOT	United States Department of Transportation.
D/U	Desired-to-undesired signal ratio [dB] available at the output of an ideal (loss less) receiving antenna.

EHF Extremely High Frequency.

Equivalent isotropically radiated power [dBW]. EIRP

Environmental Science Services Administration. **ESSA**

A propagation model (Table 2). ESSA-1970

f Frequency.

fss Facility site surface.

ft Feet.

FAA Federal Aviation Administration.

FCC Federal Communications Commission.

A level based on the Free Space propagation model (Table 2). F.S.

Gigahertz (109 Hz). GHz

Government Master File of frequency **GMF**

assignments.

 h_{rs} Effective reflecting plane elevation above

ms1 [Sec. A.3].

н Horizontally polarized antenna.

HF High Frequency (3 to 30 MHz).

ICAO International Civil Aviation Organization.

IEEE Institute of Electrical and Electronic

Engineers.

IF-73 ITS-FAA-1973 propagation model (Sec. 3).

IF-77 ITS-FAA-1977 propagation model (Table 2).

ILS Instrument Landing System.

ITS Institute for Telecommunication Sciences.

Kilohertz (10³ Hz). kHz

Kilometer (10^3 m) . km

LF Low Frequency (30 to 300 kHz).

LMR Land Mobile Radio.

Horizontal guidance portion (LOCalizer) of LOC the instrument landing system. Basic transmission loss; i.e., between L_{bf} isotropic antennas. Median basic transmission loss. L_{bm} Meters. Mean sea level. ms1 MAXimum absolute value of ΔL with the sign MAX | AL of AL retained. Median Frequency (300 to 3000 kHz). MF Megahertz (10⁶ Hz). MHz Microwave Landing System. MLS Midwest Program on Airborne Television **MPATI** Instruction. Nautical miles. n mi Nautical miles. Nm National Telecommunications and Information NTIA Administration. National Technical Information Service. NTIS Minimum monthly mean surface refractivity No (n-units) referred to mean sea level (Sec. À.3). Minimum monthly surface refractivity [N-N units] (Sec. A.3). Units of refractivity corresponding to (refractive index -1) \times 10 6 . N-units Office of Telecommunications (an agency that OT has been replaced by NTIA).

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report (Table 2).

OT/TRER-21

The propagation model used in the OT/TRER-21

 P_{R}

Median received power levels as used in Equation 2.

r

Ray path length.

rms

Root mean square.

RD

Research and Development service of the FAA.

RSMS

Radio Spectrum Measurement System.

SHF .

Super-High Frequency (3 to 30 GHz).

TACAN

TACtical Air Navigation, an air navigation aid used to provide aircraft with distance and bearing information.

TN101

A propagation model that uses the methods and equations of Technical Note 101 (Table 2).

UHF

Ultra High Frequency (300 to 3000 MHz).

V

Vertically polarized antenna.

VHF

Very High Frequency (30 to 300 MHz).

VLF

Very Low Frequency (to 30 kHz).

VOR

VHF Omni-Directional Range, an air navigation aid used to provide aircraft with bearing information.

VORTAC

A combined VOR and TACAN facility.

Δħ

Terrain parameter used to characterize terrain.

ΔL

Difference between the predicted and the observed median basic transmission loss (Table 3).

YL

Mean value of AL.

8

Scattering angle used in tropospheric scatter calculations. It is the angle between transmitter horizon to common volume ray and the common volume to receiver horizon ray as both leave their crossover point.

 $\theta_{\mathbf{h}}$

Direct ray arrival angle used on MPATI profile Figures 32, 34, 38, and 40.

Microvolts (10⁻⁶ volts).

Ω Ohms.

(...)° Degrees; e.g., 12°.

(...)' Minutes; e.g., 32'.

(...)" Seconds; e.g., 14".

°C Degrees Celsius.

°F Degrees Fahrenheit.

Approximately.

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